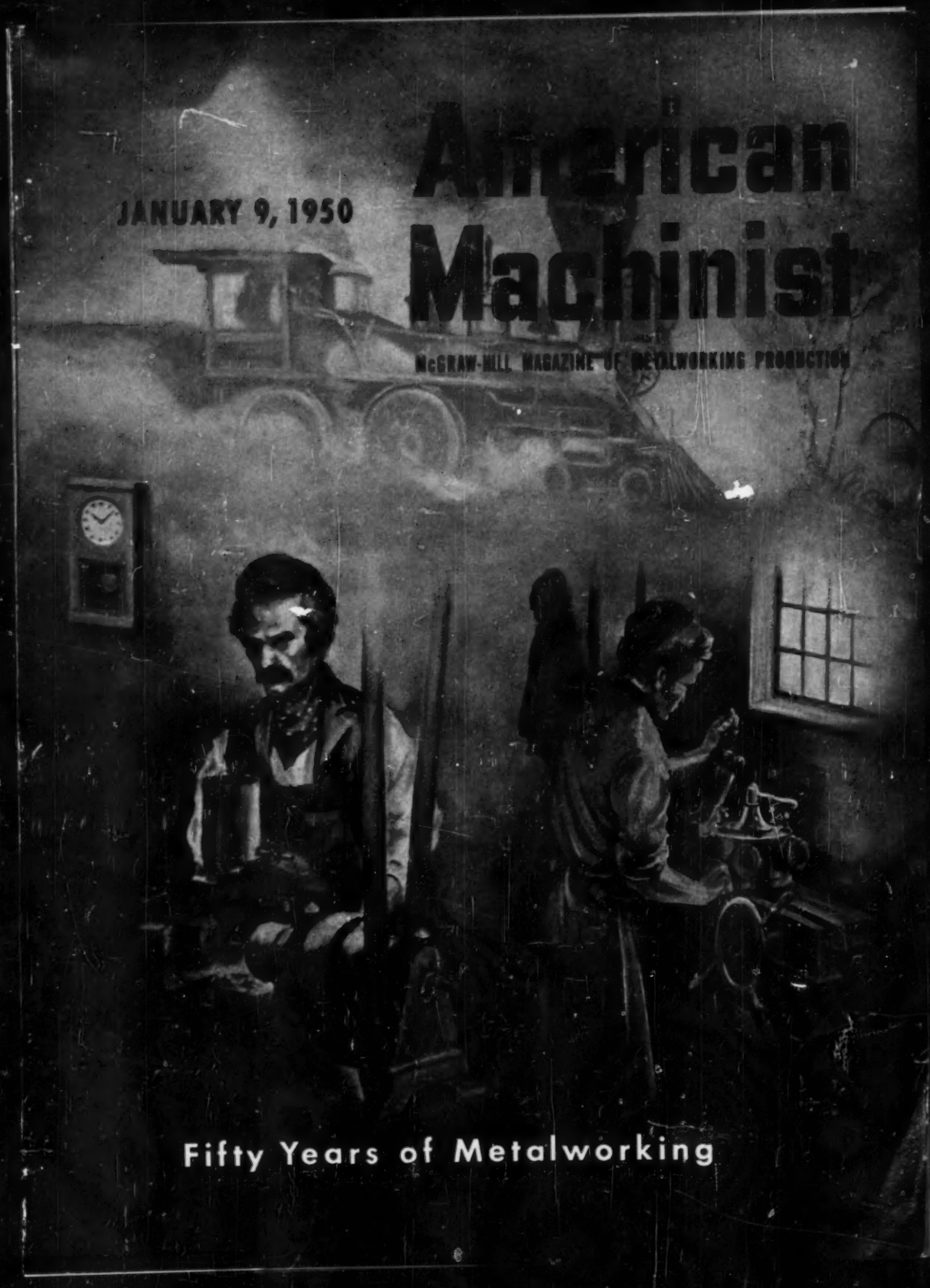
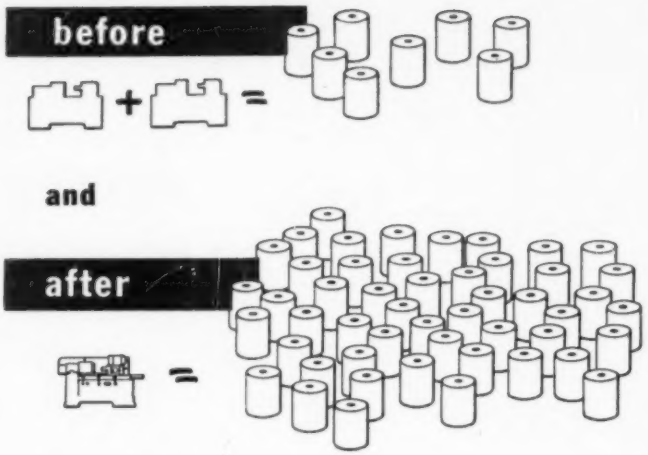

JANUARY 9, 1950
American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
Fifty Years of Metalworking

one hour's grinding production

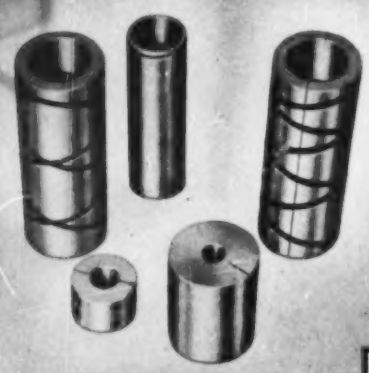


the installation of a New Heald Internal

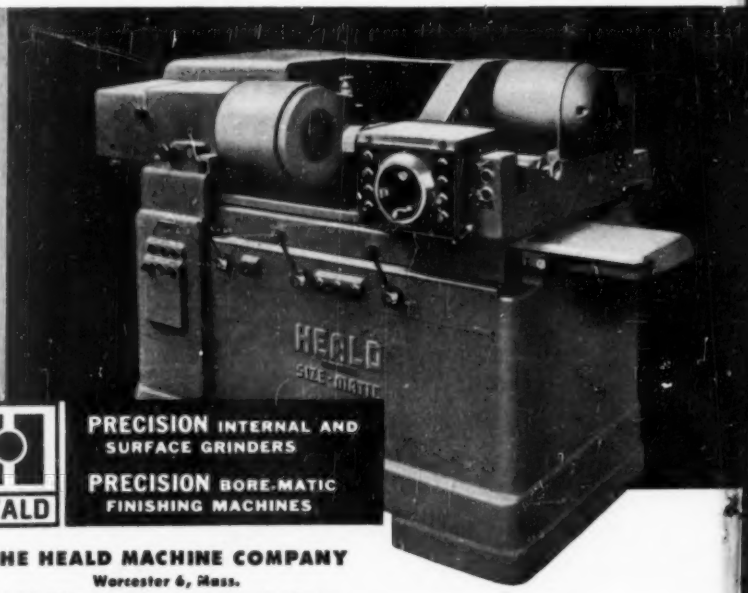
In case you didn't count them, there are *fifty* cam rollers in the "after" picture—compared to eight "before." That's how much difference a New Heald Model 271 Size-Matic Internal Grinder was able to make in the production picture of a textile machinery manufacturer. Before this Heald machine went on the job, these cam rollers were finished on two older type grinders. Now one Model 271 turns out more than six times as many parts per hour!

This machine grinds a variety of textile cam rollers, to a tolerance of .0005" for size. In the case of one part, with a long bore, a damped quill is used to help eliminate the possibility of chatter and resultant unsatisfactory finish.

This is a typical example of how Heald engineering can help to step up production schedules and cut the cost of precision finishing operations.



These five different types of textile cam rollers are internally ground faster, and with greater precision, on the Heald Model 271 Size-Matic shown above.



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PRECISION BORE-MATIC FINISHING MACHINES

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Chips and QUIPS

Our Cover . . . Readers may recall an *AM* cover depicting a toolmaker watched by his cat, published at the time of the 1948 Tool Show. Our present cover is another section of the same mural, this time showing the ancestors of the turret lathe and an early locomotive. It is a portion of the historical mural painted by Bernard F. Chapman for the reception alcove of Jones & Lamson Machine Company, Springfield, Vt. We use it here to symbolize the progress of American Metalworking in the last 50 years—to introduce our Special Report in this issue.

Gage Blocks . . . Ray Gierlich, master gage maker of DoAll Gage Division, describes how his company attains an almost perfect plane surface on gage blocks. This is the "secret" that men were offering for fancy prices when only Johansson in Sweden knew how. This will be of interest to anyone who must attain a very flat surface.

Turning the Corner . . . Fifty years ago, laymen hailed the beginning of the Twentieth Century—until the erudite editors of general magazines looked down their bespectacled noses and explained loftily that the new century didn't start until Jan. 1, 1901. We're in the same situation today on the mid-century mark, and not being erudite or lofty, we thought you'd like to take a quick and entertained look back. So Managing Editor Tangerman has dug through the issues of 1900 (when *AM* was a youthful 23) and organized a series of excerpts to recreate the picture of those leisurely times. It's surprising how many things then were like the things nowadays—and how many were very different . . . We've tried to provide you with a background upon which to make your own predictions of the half-century to come. We've attempted to rebuild the atmosphere of the time when American Metalworking really turned the corner into mass production.

Mechanized Punch Press . . . One man at Link-Belt operates a 500-ton Minster press which blanks and pierces heavy chain links. Ernest G. Noreen, supt of tool design, gives the details herewith.

Resistance . . . Wallace A. Stanley, director of production design, Progressive Welder Co., has compiled the tricky techniques that save time and money in resistance welding. We bring you a selection of the best in our current article. A second article is coming, giving more pointers.

Choosing A Tool . . . George T. Fraser of Rexalloy has prepared a broad report on proper tool selection to cut machining costs, including characteristics, tabulated surface speeds and cutting angles, etc. Here is a compendium of the latest information.

Small Shop for Rent . . . Editors will go prying about, and strange things come of it. Assistant Editor Stocker found a New York toolmaker who built a small machine shop so he had tools for experimental work, now is doing very well renting machine time to others who have special jobs to do. Bankers, businessmen, actors, writers and hobbyists are among his clients—with hobbies and business neck and neck. The story is in this issue.

Date Change . . . With this issue, *American Machinist* shifts its publication date to every other Monday. There'll be no change in schedules, but the issue we mail on a Thursday and Friday will be dated the following Monday—rather than three days after that.

Coming . . . Our next issue (Jan. 23) will be Our 37th Annual Review Number, crammed with quick pictorial descriptions of about 1500 new items of equipment parts and materials described in 1949. This is in effect a mid-century catalog of the latest in Metalworking tools. There will also be our usual 16-page statistical abstract, giving the figures for 1949 and a guess at 1950.

FILE MAN . . . E. Blair Le Ferre began with Nicholson File Company as a file cutter in the Paterson plant in the summers of 1917 and 1918. After being a machinist the summer of 1919 and a machine designer in 1921, he began full-time work as a cutting-machine setup man. By 1931 he was foreman of the machine shop. In 1932 he went to Providence as machine designer, in 1942 asst. supt. of the Providence plant. He is now mechanical engineer for all Nicholson factories and a director of the company. He has a number of inventions to his credit.

From this breadth of experience, Mr. Le Ferre has put together for us an article on how to choose and use rotary files and burs. On the personal side, he is a yachtsman, fisherman, and a "pretty good" golfer.

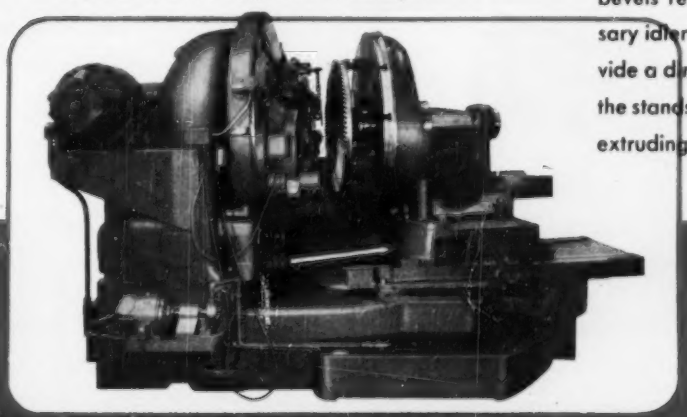
GLEASON BEVEL GEARS

CARRY HEAVY LOADS WITH COMPLETE RELIABILITY

IF YOUR POWER TRANSMISSION PROBLEM IS ONE OF
LOAD, SPEED OR ANGLE

Remember!—Bevel gears to transmit power and motion can be produced to satisfy *any* angular drive requirement without limitations as to load, speed or shaft angle.

Bevel gears have proven again and again their ability to handle the loads commonly found in heavy industry. For example, the 10" steel rod mill is a compact unit requiring a minimum of floor space. The right angle spiral bevels reduce the need for unnecessary idler gears in the gear train, provide a direct transmission of power to the stands and carry the heavy load of extruding with unfailing service.



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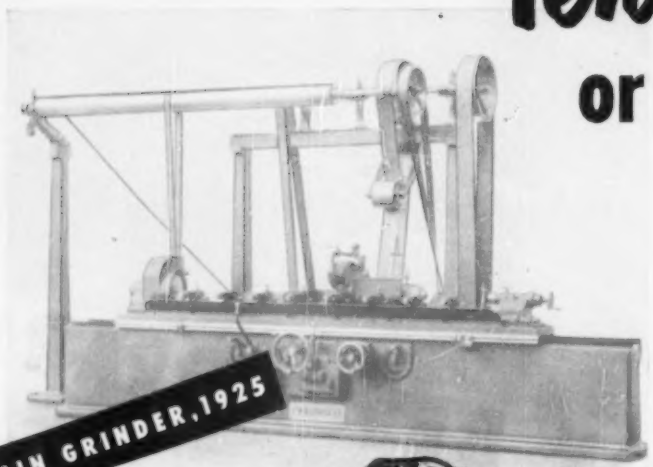
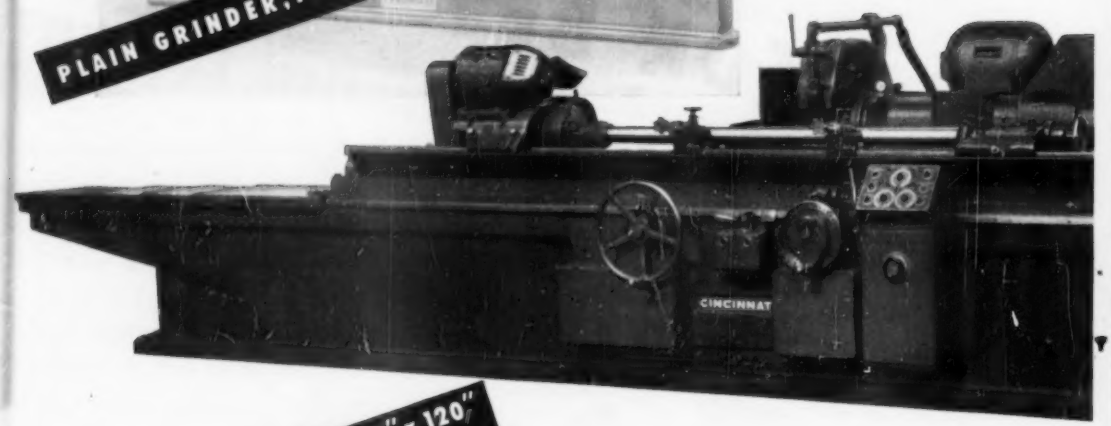
Builders of Bevel Gear Machinery for Over Eighty Years

Pensioner* or Modern



PLAIN GRINDER, 1925



New CINCINNATI FILMATIC 14" x 120" PLAIN GRINDING MACHINE
CATALOG G-594

* *The recent American Machinist Equipment Survey indicates that 22% of center type grinding machines are 10 to 20 years old, and 18% are over 20 years old. These can be profitably replaced now.*

CINCINNATI

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CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES

What is your measuring stick for obsolescence of machine tools? Cost of production? Age? Whatever it is, it's a good idea to check all your machine tools and especially those more than *10 years old. You'll find that many cost cutting improvements have been made. Perhaps these improvements have passed unnoticed, but their cumulative effect is very much worth while. Consider, for example, the many advantages offered by new CINCINNATI FILMATIC 14" and 16" Plain Grinding Machines. They far outweigh 10-year and older machines of this type.

Low Cost Producer

FILMATIC

New ELECTRONIC TABLE TRAVERSE CONTROL . . . A TWIST OF A DIAL SELECTS THE CORRECT RATE OF TABLE TRAVERSE.

New BUILT-IN ELECTRICAL CONTROL STATION . . . AT THE OPERATOR'S RIGHT HAND FOR MAXIMUM CONVENIENCE OF OPERATION.

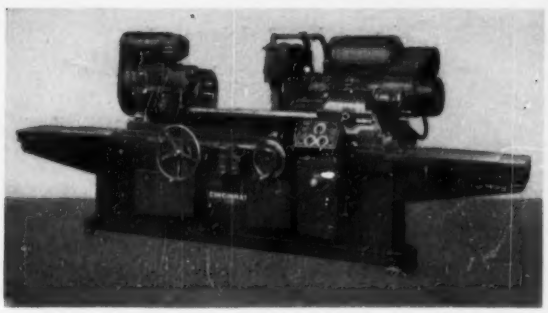
New TABLE DRIVE . . . NO GEAR BOX REQUIRED, FEWER WEARING PARTS.

New AUTOMATIC WHEEL BALANCING . . . AN EXTRA COST FEATURE THAT QUICKLY PAYS FOR ITSELF.

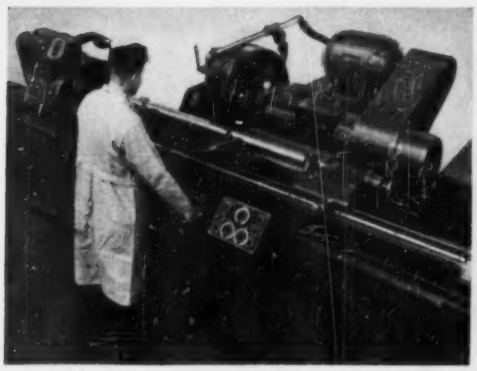
FILMATIC GRINDING WHEEL SPINDLE BEARINGS..

still the best bearing employed in any grinding machine. Require no adjustment; no attention for years!

Just these few advantages make older machines an expense rather than an asset. Many additional benefits, offered by new CINCINNATI FILMATIC 14" and 16" Plain Grinders, are outlined in an attractive new catalog, No. G-594. May we send a copy to you?



New CINCINNATI FILMATIC 16" x 36" Plain Grinding Machine. Also built in 14" size. Both 14" and 16" machines are built in 36", 48", 72", 96", 120", 144" and 168" lengths.



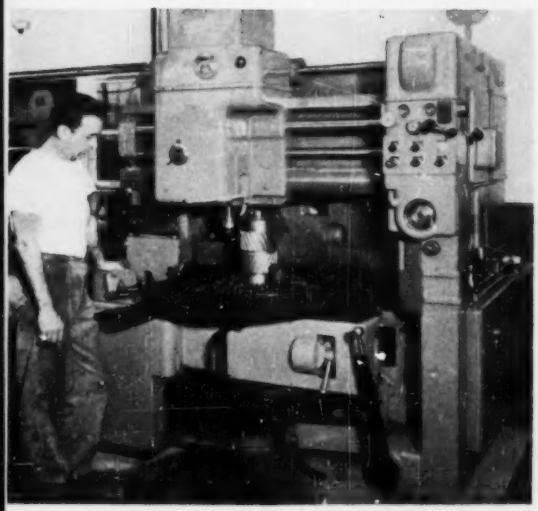
Convenience of operating controls and electrical push button panel are evident in this picture. Everything is readily accessible.

GEARS...without

GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

Growl... FOR MARINE PROPULSION



The Fellows No. 36 Gear Shaper installed for cutting production-run quantities of speed reduction and reverse gears at Snow and Nabstedt Gear Corp., New Haven, Conn.

The massive rigidity of this big No. 36 Gear Shaper opens up broad avenues of time saving in the cutting of heavy-duty precision gears with helical, spur or herringbone teeth... Power to hog out stock and precision to hold finish cuts to "tenths"... Speed and feed changes made in seconds... Well worth investigating! Complete literature on request.

ROUGHING AND PRE-SHAVING PERFORMANCE

at Snow & Nabstedt Gear Corp., New Haven, Conn. —manufacturers of S-N Marine Reverse and Reduction Gears.

WORK: 57-tooth Herringbone Gear, 14.250 inches P.D.... and 25-tooth Mating Pinion, 6.250 inches P.D. (both SAE 8620 steel)

TOOTH CHARACTERISTICS:	
Diametral Pitch	4/5
Pressure Angle	20 degrees
Helix Angle	23 degrees
Face Width	3.375 inches
Whole Tooth Depth	.475 inches
GEAR SHAPER SETTING:	
Strokes per minute	86
Feed per stroke	.0225 inches
ROUGHING TIME:	
(Material Normalized Prior to Cutting)	
Gear (in one cut)	26.5 minutes
Pinion (in one cut)	13.5 minutes
PRE-SHAVING:	
(After Carburization)	
Gear (in one cut)	23.5 minutes
Pinion (in one cut)	10.5 minutes

SAME GEARS SHAVED ON FELLOWS SHAVING MACHINES
with minimum stock removal, minimum correction needed.

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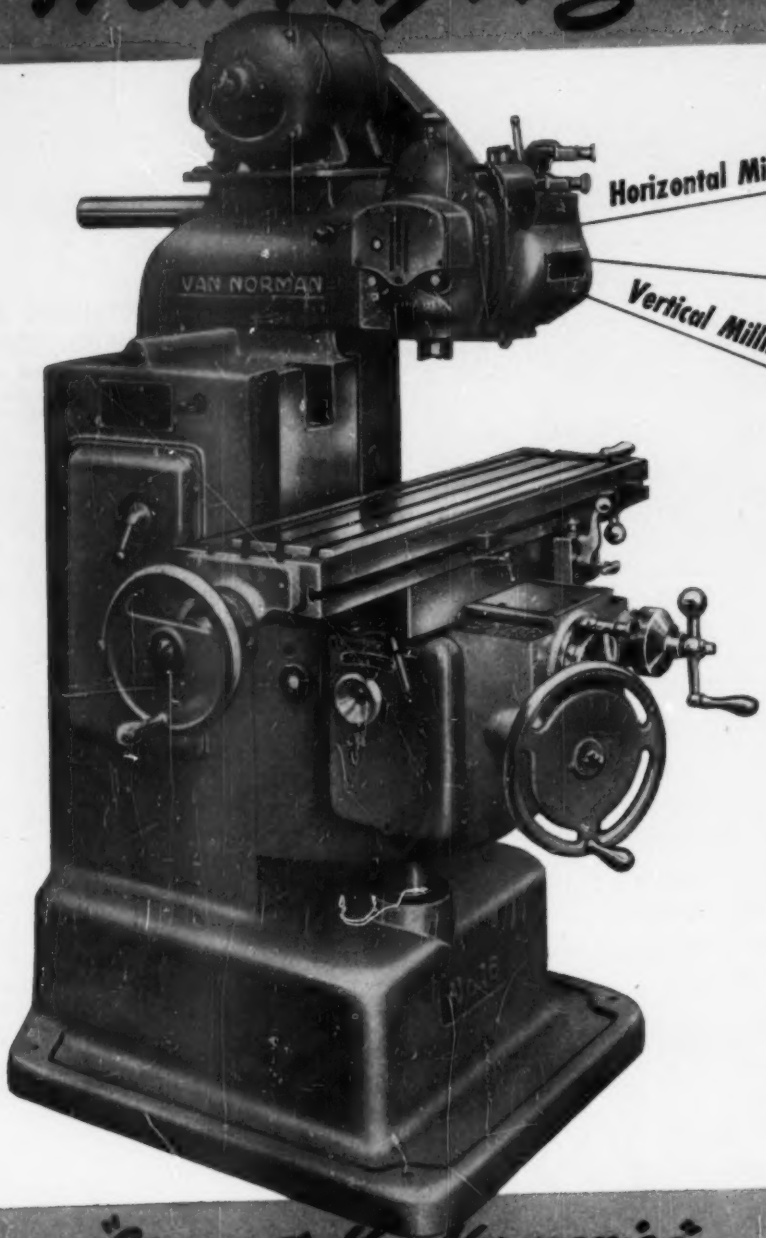
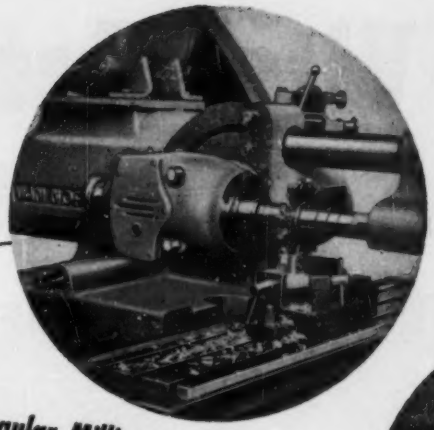
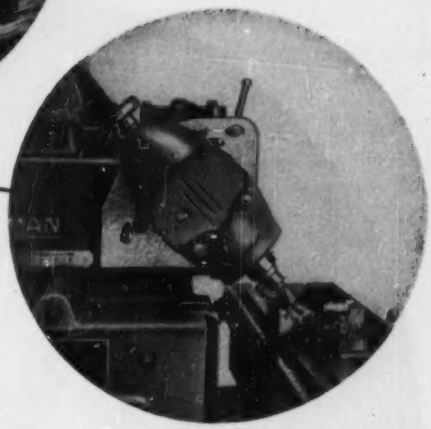
From Any Angle . . .

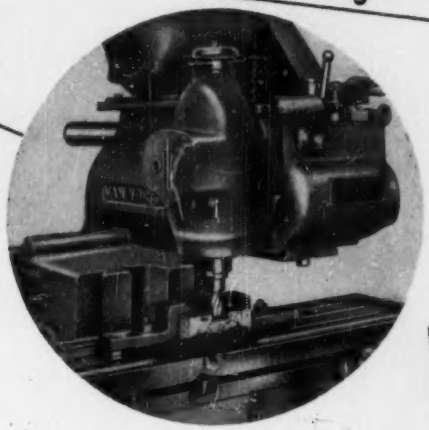


"It pays to Van Norman-ize"



Angular Milling





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NO. 16 RAM TYPE MILLING MACHINES INCREASE PRODUCTIVITY

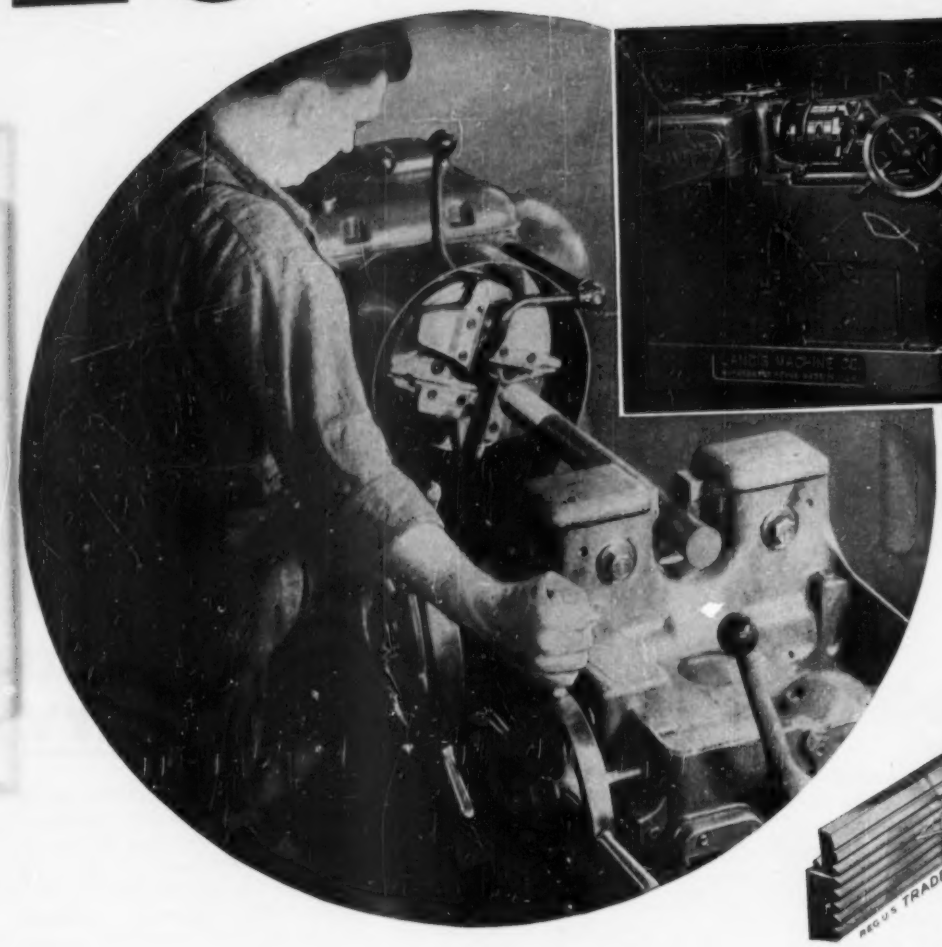
This Van Norman No. 16 Miller gives you many outstanding and exclusive advantages that assure more workability for your plant.

The adjustable cutterhead, which permits vertical, horizontal or angular milling on one machine, cuts idle machine time by as much as 50%. The moveable ram plus the saddle cross feed increases the work range and capacity of the miller . . . enables you to handle larger work pieces with ease. Single lever built-in electrical control simplifies operation. Spindle speeds from 95 to 2,000 rpm give you the right speed for every type of cut. Add such construction features as hardened alloy steel gears, large hardened alloy steel multi-splined shafts, precision-ground feed screws, one-shot metered lubrication and you have a milling machine that provides greatest productivity, lowest cost milling and long operating life.

Write for bulletin, today

VAN NORMAN COMPANY
Springfield 7, Massachusetts

16 Vital Reasons LANDMACO

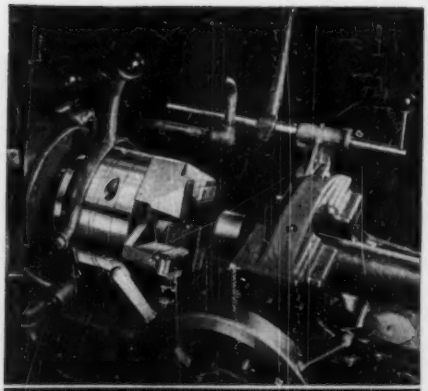


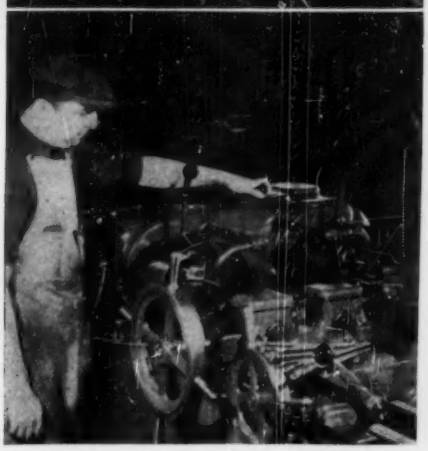
THE LANDIS CHASER

LANDIS TRADE-MARK

LANDIS

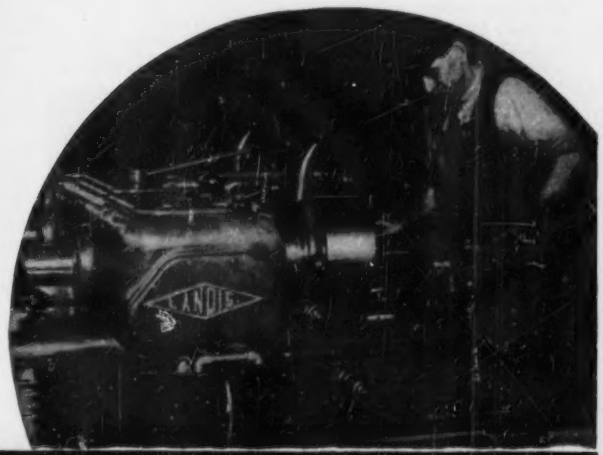
for the Superiority of THREADING MACHINES





The many new and exclusive features of LANDMACO Threading machines combine to assure the greatest possible degree of accuracy, ease of operation and flexibility in making set-up changes.

- Single Pulley Drive.
- Self-contained selective type gear box provides eight spindle speeds.
- Flood lubrication for all gears and bearings.
- Gear type pump driven and automatically reversible.
- Built-in pump can be removed without disconnecting any piping.
- Motor-in-base affords compact and efficient motor drive.
- Friction clutch control.
- Head opens and closes automatically.
- Hand lever for opening and closing head.
- Semi-steel bed of box type reinforced by inner walls.
- Minimum die head overhang.
- Adjustable vise easily lined up with spindle.
- Oil reservoir lubricates guides through felt pads in carriage base.
- Gibbed carriage compensates for wear.
- The heavy rim of vise hand-wheel, giving fly-wheel effect, facilitates gripping of work.
- Guards completely cover and protect guides.



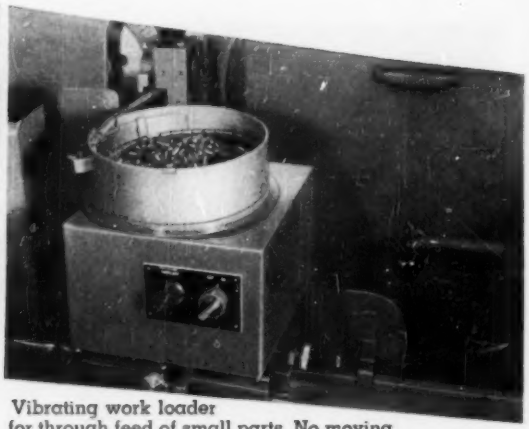
MACHINE CO. WAYNESBORO PENNA. U.S.A.

GRINDING IDEAS with versatile

production increased up to 400%
accurate thread form
bright finish

THREAD GRINDING

Typical threads that can be ground on hardened or unhardened stock by through feed on a single pass to as close as class III fit. Also suitable for parts made of powdered metal, hard rubber, plastics, aluminum, brass from solid stock or tubing.

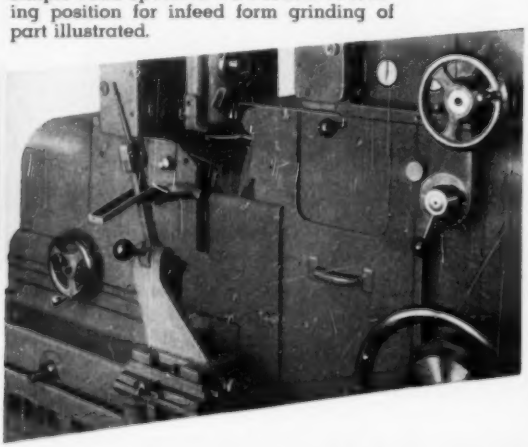


Vibrating work loader for through feed of small parts. No moving parts to wear, no lubrication points to attend.

Grinding wheel may be crush formed or diamond dressed to shape. Regulating wheel diamond dressed to desired form. Production 250 per hour, 0.020" stock removal. Fine finish permits chrome plating without finishing operation previously required.

INFEED FORM GRINDING

Simple hand operated work loader in loading position for infeed form grinding of part illustrated.



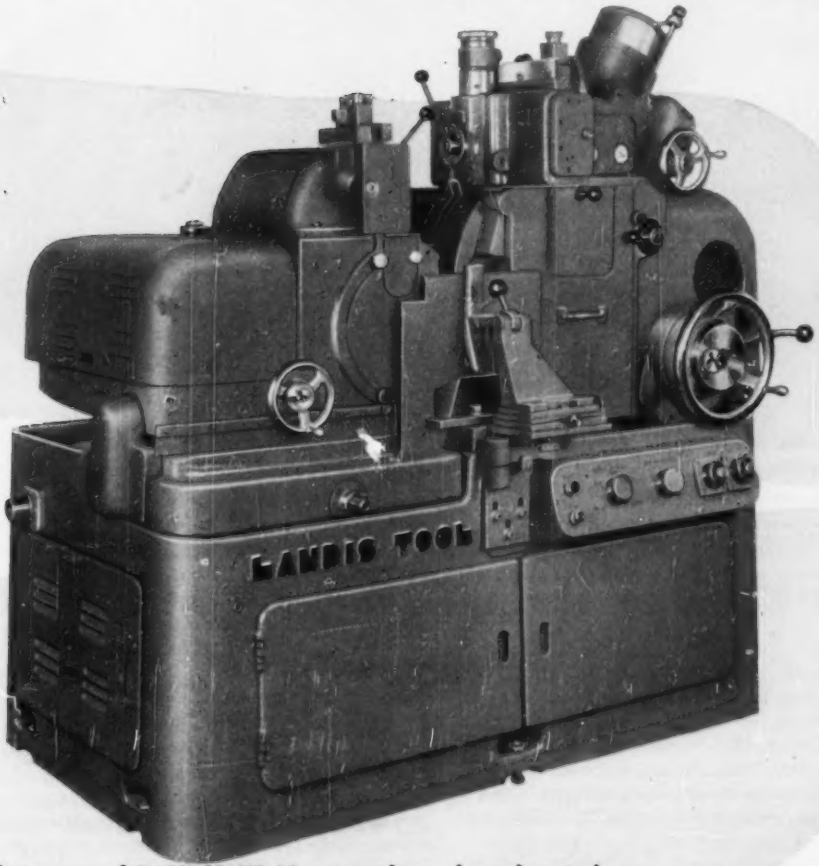
production doubled
finishing operation eliminated

If you have a precision grinding problem, production estimates and tooling suggestions will be made on the basis of your blueprints.

LANDIS TOOL COMPANY WAYNESBORO, PENNA.

LANDIS TOOL Centerless Thread Grinder

Centerless thread grinding pioneered by LANDIS TOOL. These grinders backed by more than 50 years of experience in manufacturing precision grinding machines.

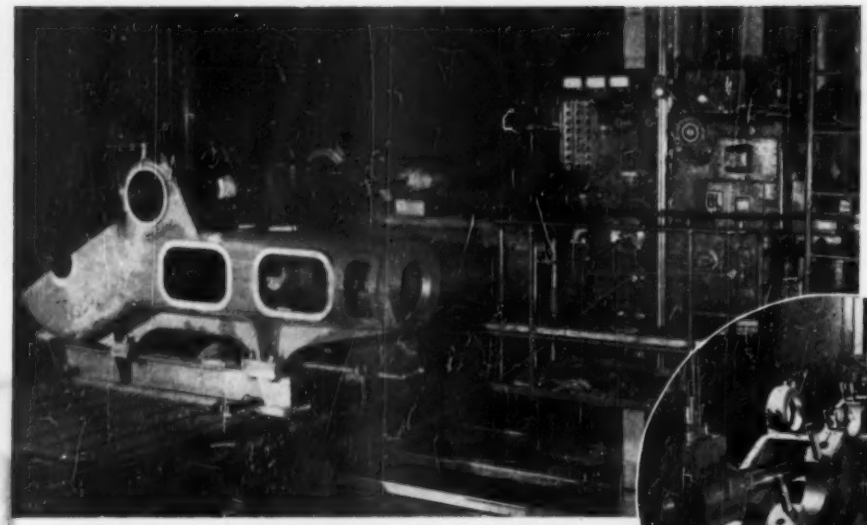


features of LANDIS TOOL centerless thread grinder

Microsphere bearings—both wheel spindles
Work rest solidly mounted on bed
Simple variable speed control
for regulating wheel

For details request Bulletin CTG47

LANDIS TOOL
Precision Grinders



Pump body mounted on parallels and clamped to machine table. Note remote control panel which enables operator to watch internal boring operations.

View of pump body showing boring bar extending through cross bore head. Angular cover surface, bolt holes and pinion and crank bearings have been machined.

HOW TO ELIMINATE LAYOUT WORK

and complete all operations on one machine

G & L Scales and Verniers Locate All Dimensions; Milling, Boring, Drilling and Tapping are Performed in Five Simple Settings.

● It is usual practice to depend upon G & L machines with scales and verniers to hold dimensions to .002" on general work. This means that work can be taken directly to the machine without first laying out surfaces to be milled, holes to be drilled and center distances to be maintained.

On this pump frame, the following dimensions were held without layout — pinion to crank 35.250/35.248 — cross head to cross head 39.000 plus or minus .002 — crank bore 19.748/19.746 — pinion two bores 12.123/12.121 and 13.998/13.996 — cross head bores 17.000 plus .002 minus .000. The scales and verniers regularly furnished with the machine were depended upon entirely to align all bores, drill all holes and mill all surfaces.

This is a typical example showing how a G & L Horizontal Boring, Drilling and Milling Machine is used to completely machine a workpiece. From the time the pump body feet were machined to the time the part was completed, it did not leave the horizontal boring mill. All milling, facing, drilling, tapping, recessing, backfacing and counterboring was done on one machine. It was necessary, of course, to change the position of the work in order to perform successive operations. The entire assembly was manually indexed with stop blocks and pins against parallels.

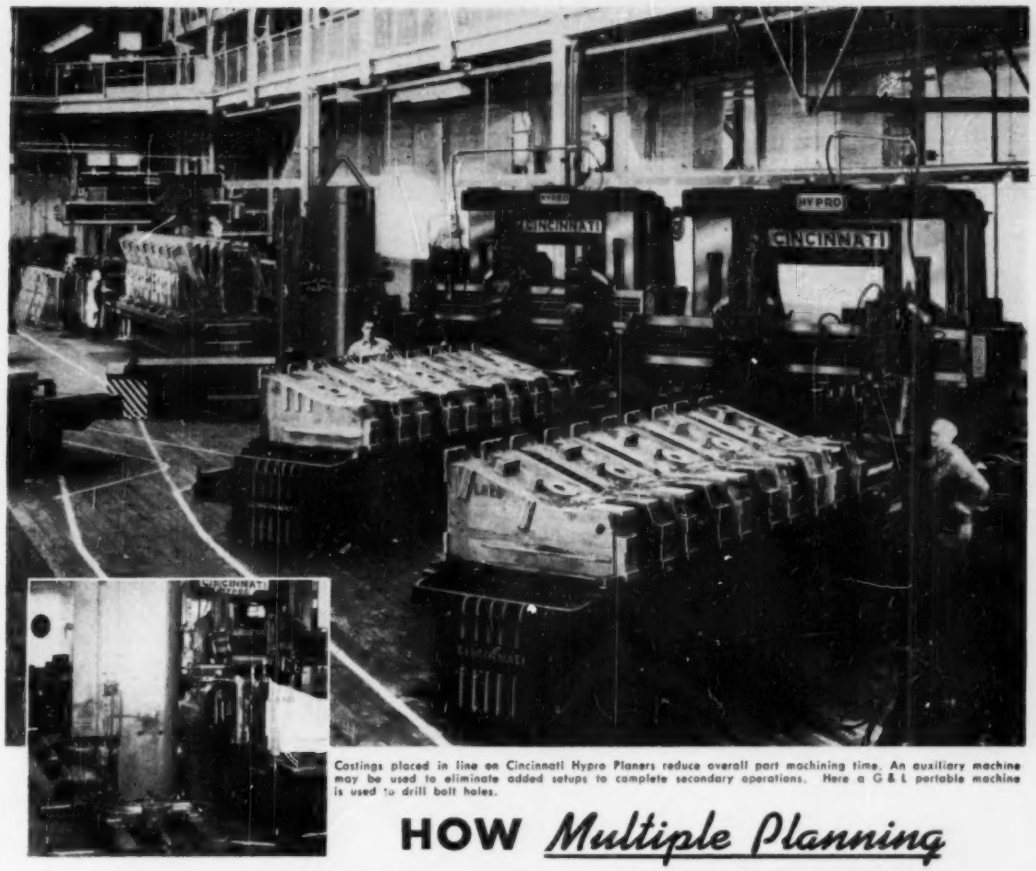
A continuous feed facing head was used to face and backface the cross head ends. A remote control panel enables the operator to leave his position on the operating platform and control the machine as he watches the operation at the cutting tool.

If you are spending valuable man hours in laying out similar work in your own plant, it is possible the G & L Horizontal Boring, Drilling and Milling Machine can eliminate this costly operation for you. Our engineers will be glad to study your machining problem and advise where savings can be made. There is no obligation for this service.

Additional Data

covering the complete line of Giddings and Lewis machines and accessories can be found in the Giddings and Lewis General Catalog. Write for your copy today. Please indicate your business connection.

GIDDINGS & LEWIS MACHINE TOOL COMPANY
FOND DU LAC, WISCONSIN, U. S. A.



Castings placed in line on Cincinnati Hypro Planers reduce overall part machining time. An auxiliary machine may be used to eliminate added setups to complete secondary operations. Here a G & L portable machine is used to drill bolt holes.

HOW *Multiple Planning* GIVES MORE *Economical* PRODUCTION

Right and Left Hand Castings are Mounted in Line for Identical Operations — 4 Heads Remove Metal Simultaneously in Numerous Interrupted Cuts!

Worthwhile savings in overall production time automatically result when parts are handled in multiples and placed in a row for planing. With castings arranged in consecutive order, the cutters mounted on the four heads remove metal simultaneously from bosses, pads, and plain surfaces. This string method of work mounting not only offers faster and more economical production, but also assures greater uniformity and accuracy of finished parts.

The castings are mounted on parallels aligned with the machine table. They are rigidly clamped and bolted in place with minimum distances between parts. Two heads mounted on the machine rail plane the top pads and bosses. Right and left hand side heads machine the two side surfaces of the casting. All cutters are engaged at the same time and plane the parts in consecutive order as the table feed cycle progresses. There is little chance for variation in final dimensions when workpieces are handled in this manner.

Taking Full Advantage of Initial Work Setup

After the parts have been planed and while they are still on the Cincinnati Hypro Planer, an auxiliary G & L Portable machine is used for drilling bolt holes in the castings. This machine is mounted immediately adjacent to the planer and drills ten holes in each casting before the latter is removed from the planer table. Operations of this type indicate how overall production time is cut by eliminating certain setup operations.

If you are not now taking full advantage of in-line part arrangement for multiple planing operations, Cincinnati Planer Company Engineers will be glad to advise you on this important cost reducing machining method. Inquire now without obligation.

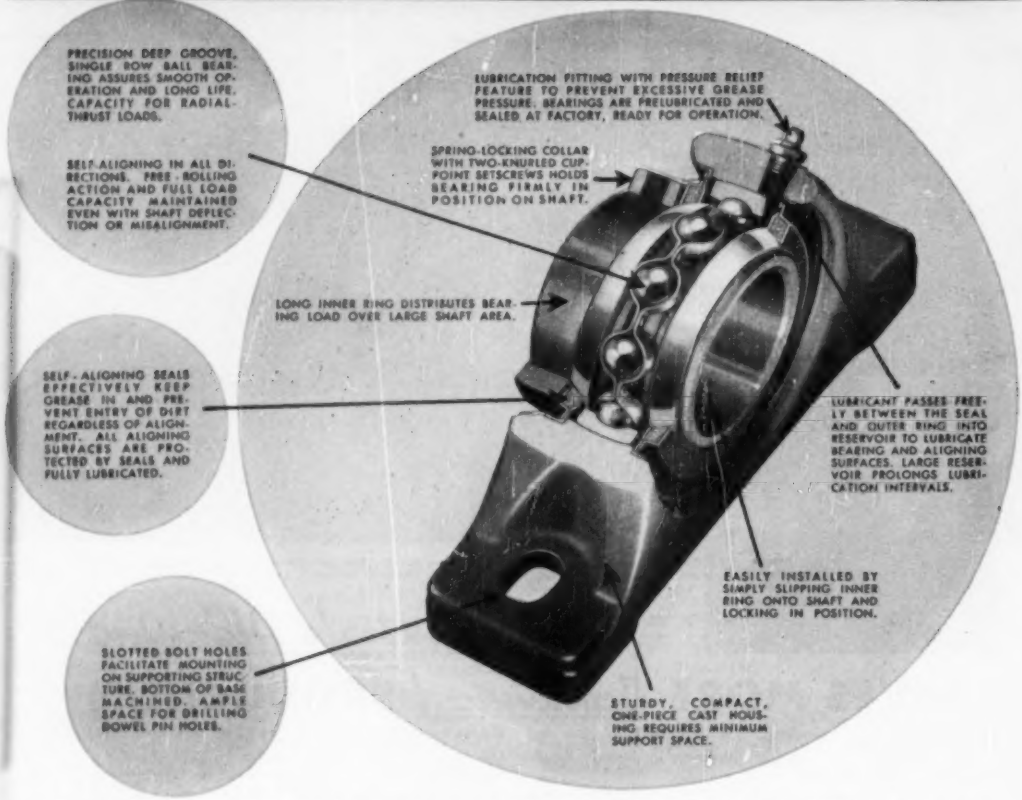
THE CINCINNATI PLANER COMPANY

(SUBSIDIARY OF GIDDINGS AND LEWIS MACHINE TOOL COMPANY)

CINCINNATI 9, OHIO, U. S. A.

HYPRO

PLUS VALUES in Series 200 LINK-BELT *Ball Bearing* BLOCKS


PRECISION DEEP GROOVE, SINGLE ROW BALL BEARING ASSURES SMOOTH OPERATION AND LONG LIFE. CAPACITY FOR RADIAL-THRUST LOADS.
SELF-ALIGNING IN ALL DIRECTIONS. FREE-ROLLING ACTION AND FULL LOAD CAPACITY MAINTAINED EVEN WITH SHAFT DEFLECTION OR MISALIGNMENT.
SELF-ALIGNING SEALS EFFECTIVELY KEEP GREASE IN AND PREVENT ENTRY OF DIRT REGARDLESS OF ALIGNMENT. ALL ALIGNING SURFACES ARE PROTECTED BY SEALS AND FULLY LUBRICATED.
SLOTTED BOLT HOLES FACILITATE MOUNTING ON SUPPORTING STRUCTURE. BOTTOM OF BASE MACHINED. AMPLE SPACE FOR DRILLING DOWEL PIN HOLES.
LUBRICATION FITTING WITH PRESSURE RELIEF FEATURE TO PREVENT EXCESSIVE GREASE PRESSURE. BEARINGS ARE PRELUBRICATED AND SEALED AT FACTORY, READY FOR OPERATION.
SPRING-LOCKING COLLAR WITH TWO-KNURLED CUP-POINT SETSCREWS HOLDS BEARING FIRMLY IN POSITION ON SHAFT.
LONG INNER RING DISTRIBUTES BEARING LOAD OVER LARGE SHAFT AREA.
LUBRICANT PASSES FREELY BETWEEN THE SEAL AND OUTER RING INTO RESERVOIR TO LUBRICATE BEARING AND ALIGNING SURFACES. LARGE RESERVOIR PROLONGS LUBRICATION INTERVALS.
EASILY INSTALLED BY SIMPLY SLIPPING INNER RING ONTO SHAFT AND LOCKING IN POSITION.
STURDY, COMPACT, ONE-PIECE CAST HOUSING REQUIRES MINIMUM SUPPORT SPACE.

Send for Catalog No. 2550

Highlighted above are several of the PLUS VALUES built into Series 200 Link-Belt Ball Bearing Pillow Blocks. No wonder bearing users are specifying LINK-BELT more and more . . . for dependability, for free-rolling action, for economy. Link-Belt Company — serving industry since 1875 — offers a COMPLETE LINE of mounted and unmounted Ball and Roller Bearings for every type of industrial application.

VARIETY OF MOUNTINGS for WIDE RANGE OF APPLICATIONS

FLANGED BLOCK

TAKE-UP BLOCK

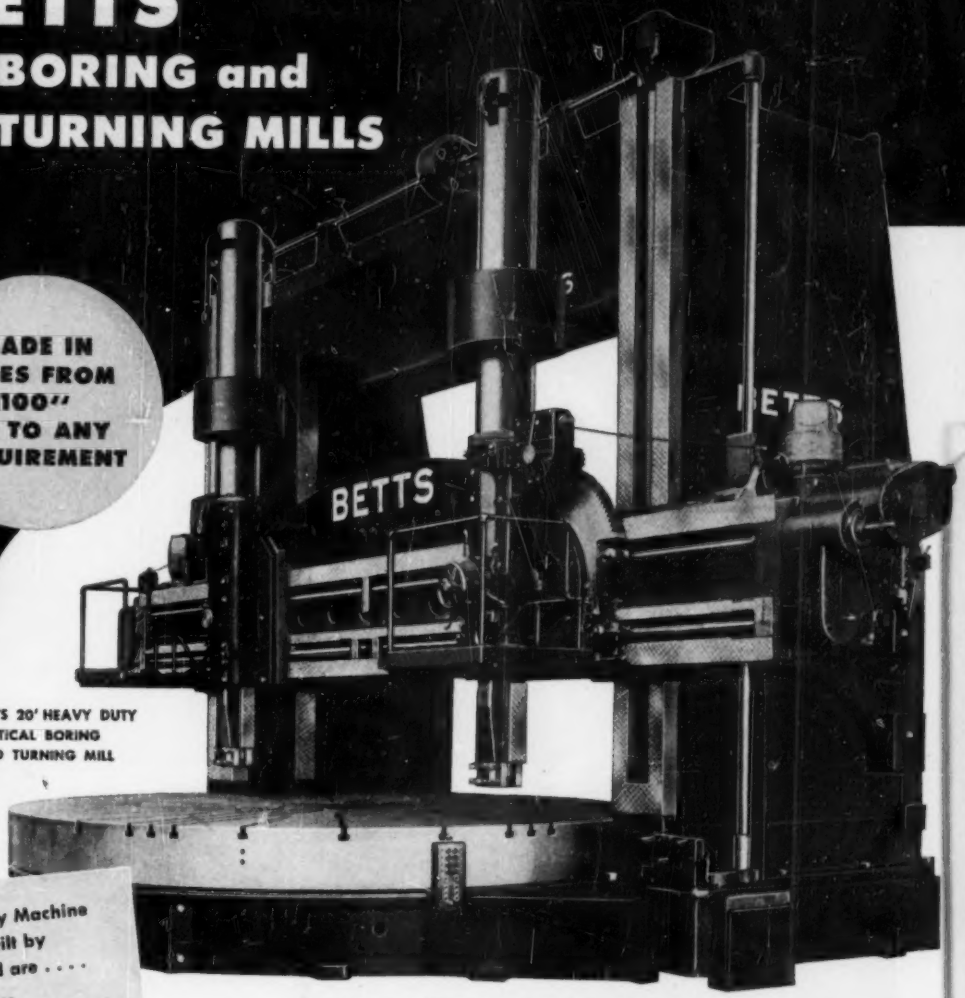
HANGER BLOCK

LINK-BELT COMPANY

Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.
Offices, Factory Branch Stores and Distributors in Principal Cities. 11,701

BETTS
BORING and TURNING MILLS

MADE IN SIZES FROM 100" UP TO ANY REQUIREMENT



BETTS 20' HEAVY DUTY VERTICAL BORING AND TURNING MILL

Among Heavy Machine Tools built by Consolidated are . . . .

- LATHES
- BORING MILLS
- DRILL PRESSES
- MILLING MACHINES
- BORING MACHINES
- COLD SAW MACHINES
- BORING, DRILLING AND MILLING MACHINES
- DRILL AND TOOL GRINDERS
- PLANERS
- SLOTTERS
- RAILROAD SHOP TOOLS
- AUTOMOTIVE TOOLS
- AND OTHER SPECIAL MACHINES

Betts Heavy Duty Boring and Turning Mills are general purpose tools of simple, rugged design particulary adapted to heavy continuous operations requiring a high degree of accuracy combined with power. Among the outstanding features that have made Betts Mills leaders in their field, is their type of table mounting that insures positive concentricity. They are built in a size range from 100" swing up to any size to meet your requirements.

Full information covering any size Betts Boring and Turning Mill in which you are interested will be furnished upon request.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK

It's no trick to save money in your TOOL ROOM

"BEST WHEEL WE EVER HAD . . .

Cuts fast and cool, gives good finish and stays sharp", that is the recent report from a large Wisconsin manufacturer on the 32 ALUNDUM wheels which they use to sharpen high speed steel cutters on their Ingersoll cutter grinder. They've been enthusiastic ever since they first tried "32" on this job in 1946 using a 32A60-I8VBE. They remove up to .050" of stock at .002" per pass, holding face runout to .0005" and periphery runout to .001" with no difficulty.

. . . with Cost Cutting 32 ALUNDUM Tool Grinding Wheels

4 to 6 Times Faster Cutting

In plant after plant they are finding that the *extra sharpness* of 32 ALUNDUM wheels enables them to remove stock from high speed steel and cast alloy tools at the rate of .002" to .003" per pass as compared to .0005" for ordinary tool wheels.

No Dressing on Multi-tooth Cutters

And "32" wheels *stay sharp* longer. You can go all the way around even a large multi-tooth cutter without having to stop and dress a 32 ALUNDUM wheel.

Less Tool Spoilage

32 ALUNDUM grinding wheels cut so cool that there's far less danger of spoiling heat-sensitive high speed steel tools—even with inexperienced operators.

Here's the Reason for "32's" Record Breaking Performance

— *The grains of 32 ALUNDUM abrasive are produced by a special, patented electric furnace process which gives them many sharp points on all sides—no matter how they are bonded into a wheel each grain presents one or more cutting faces. And because the grains are over 99% pure fused alumina they have exceptional resistance to dulling.*

W-1271

- LATHE TOOLS
- PLANER TOOLS
- MILLING CUTTERS
- REAMERS
- BROACHES
- DRILLS
- TAPS
- CHASERS
- HOBS
- FORM TOOLS
- SLITTING SAWS

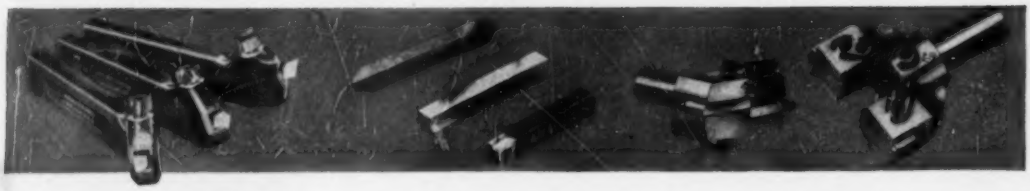
NORTON

162 Pages of Practical Information—That's what you get in this Norton Handbook on Tool Room Grinding. It tells you when to use 32 ALUNDUM wheels and when to use the other Norton abrasives—such as 38 ALUNDUM, 57 ALUNDUM and regular ALUNDUM, to cut tool room costs. Send for your copy—just ask for Form 835-P.

NORTON COMPANY, WORCESTER 6, MASS. — Warehouses in Principal Cities — Distributors in All Principal Cities

ARMSTRONG

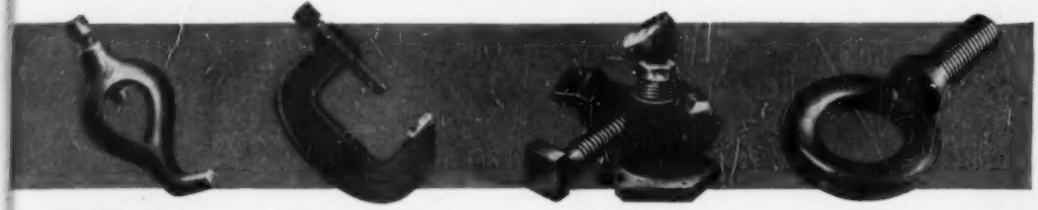
Quality TOOLS



ARMSTRONG TOOL HOLDERS
Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.

ARMSTRONG HIGH SPEED
Ready-to-grind Bits...Ground Cutters.
ARMALOY Cast Alloy CUTTER-BITS
ARMIDE Carbide-Tipped CUTTERS
6 cutter shapes, 12 sizes—2 grades.

ARMSTRONG Turret Lathe and Screw Machine TOOL HOLDERS
Drill Holders, Cutter Holders, Finishing and Knurling Tools for standard operations.



ARMSTRONG Drop Forged DOGS
Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.

ARMSTRONG Drop Forged "C" CLAMPS
Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also Machinists' Clamps.

ARMSTRONG Setting Up Tools
A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.

ARMSTRONG Drop Forged Eye Bolts
Plain or shoulder pattern. Blank or Threaded. 14 sizes, Drop Forged and heat treated.

ARMSTRONG Ratchet Drills
All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible.

ARMSTRONG Drop Forged Wrenches
Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating ... stronger.

ARMSTRONG Detachable Socket Wrenches
All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.

ARMSTRONG Machine Shop Specialties
Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vises.

ARMSTRONG BROS.

Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5215 W. Armstrong Ave. Chicago 30, Ill.
Eastern Whse. and Sales: 199 Lafayette St., New York 12, New York
Pacific Coast Whse. and Sales Office: 1275 Mission St., San Francisco 3, Calif.

Operators acclaim it as a money maker!

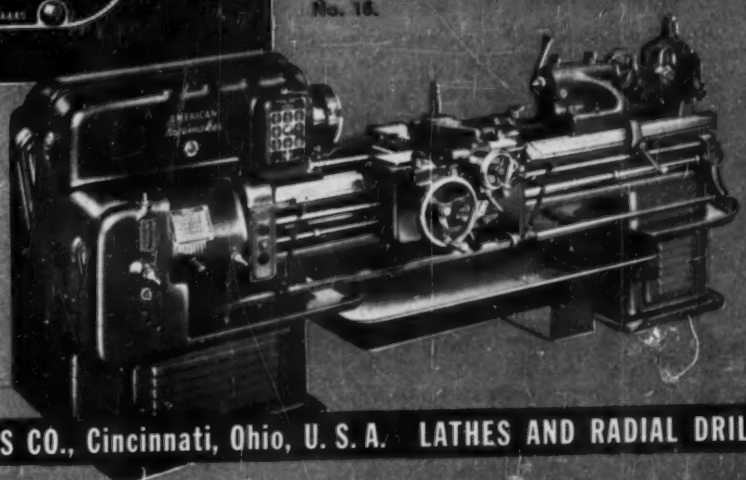
Whenever operators enthusiastically acclaim a feature as a money maker for them it automatically follows that it is likewise a money maker for the owners.

The direct reading speed control of "AMERICAN" Pacemaker Lathes is a real money maker and operators freely admit it. It makes their work easier; they can secure the right speed quicker; they produce more work because of it and, what is of paramount importance, the pay roll dollar buys more as a consequence.

The direct reading speed control unit shows at a glance the available speeds and the simple means of securing them. Imagine 27 spindle speeds being secured through only two conveniently placed direct reading levers without having to refer to index plates or having to retain lever positions in mind.

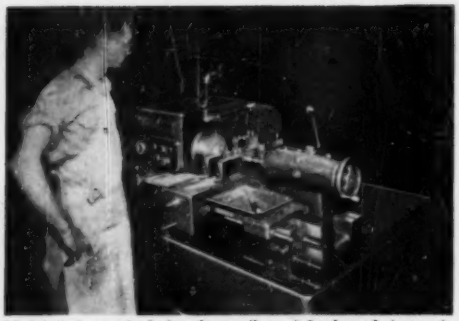
Furthermore, the simplicity of this mechanism and the infinitesimal time required to make speed changes inspire operator confidence and encourage him to make changes necessary to secure correct cutting speeds.

This and other fine features of the "AMERICAN" Pacemaker are thoroughly illustrated and described by Bulletin No. 16.



THE AMERICAN TOOL WORKS CO., Cincinnati, Ohio, U. S. A. LATHES AND RADIAL DRILLS

WHY YOU CAN CUT COSTS WITH THESE NEW SUNDSTRAND AUTOMATIC LATHES



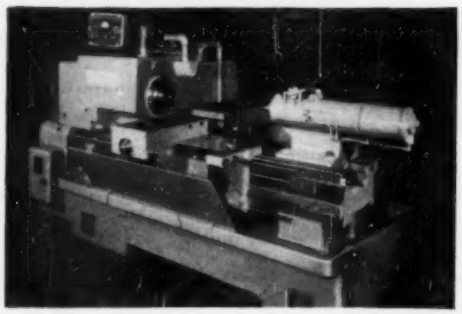
Model 4 Automatic Lathe, the smallest of Sundstrand Automatic Lathes, is ideal for turning a wide variety of small parts. Maximum swing is 9½" diameter.

The over 7,700 users of Sundstrand Lathes have always found them a profitable investment. Many have changed from old to new Sundstrands and received the benefits of the higher productivity resulting from design improvements. The following features incorporated in the design of the latest models of Sundstrand Automatic Lathes will help you cut costs further. Call in a Sundstrand engineer to assist you in selecting the proper method and machine for your work. There is no obligation for this service.

Sundstrand Model 8A takes up to 25 HP spindle drive motor. Maximum swing is 12⅛" diameter.

Greater Horse Power

All new Sundstrand Automatic Lathes have been redesigned for greater rigidity and larger spindle drive motors. They have ample power for use of carbide cutting tools and are capable of doing more work. Note the massive headstock design in the machines illustrated.



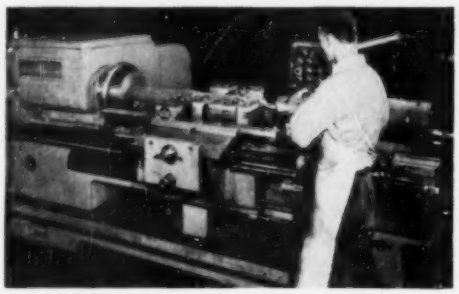
Sundstrand Model 12A, a new automatic lathe for handling work within a 15⅝" diameter swing. Can be furnished with longer beds.

Wider Feed Range

A wider feed range has been provided to enable the handling of a greater range of parts and materials at maximum cutting efficiency. The new Models 4, 8A and 12A have a ratio of 18 to 1 between high and low feeds — Model 16 has an even greater range.

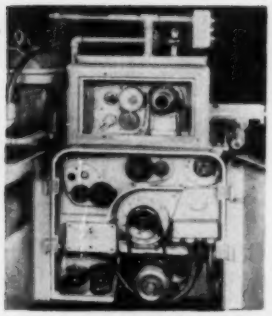
Greater Carriage Adjustment

Both front and rear carriage of the latest Sundstrand Automatic Lathes are adjustable full length between headstock and tailstock centers — another important new feature.



Sundstrand Model 16 Automatic Lathe has large swing (17" swing over slides) and a 75 HP motor for heavy cuts and carbide cutting tools.

RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT



Faster Set-Up

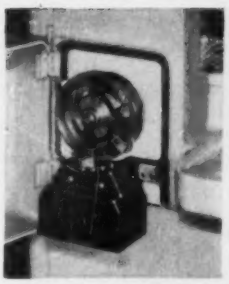
The photo at the left is an end view of machine showing convenient location of pick-off gears for changing spindle speeds and front and rear carriage feeds. The feed and speed chart and pick-off gear storage compartment are all readily accessible for quick set-up or changeover.

Wider Speed Range

Spindle speed range ratios have been increased to 30 to 1 on all new Model Sundstrand Automatic Lathes to obtain maximum in cutting efficiency over a wider range of sizes of parts and material. The spindle unit is equipped with two driving gear centers, which increase the range between high and low spindle speeds. In addition, four speed changes can be obtained from one set of gears instead of the usual two.

Automatic Lubrication

To insure long machine life and lower maintenance costs, all moving parts within the machine, such as spindle bearings, gears, carriage and cross slide ways, are provided with automatic lubrication.



Quick Cycle Change-Over

Complete control of all cycles is provided by adjustment of dogs on a disk. Making cams is eliminated. Changing position of dogs on disk changes length of rapid approach, feed and rapid return strokes — enables operator to set up cycle quickly and changeover from one job to another easily.

Automatic De-Clutching

All new Sundstrand models have been provided with automatic declutching between spindle and spindle motor with self-adjusting magnetic clutch and brake for quick stopping of spindle rotation.

Screw Feed to Front Carriage

All new Sundstrand Automatic Lathes have screw instead of rack feed to the front carriage — resulting in fine finish and long tool life.

Hardened and Ground Carriage Ways

All new Model Sundstrand Automatic Lathes have hardened and ground carriage and cross slide ways.

4 Models Cover H.P. Range of 3 to 75 H.P.

	MODEL 4	MODEL 8A	MODEL 12A	MODEL 16
SPINDLE MOTOR	3 to 7½ HP	10 to 25 HP	20 to 50 HP	50 to 75 HP
SPEED RANGE Type A	30 to 1800 RPM	40 to 1200 RPM	30 to 900 RPM	15 to 750 RPM
SPEED RANGE Type B	60 to 3600 RPM	80 to 2400 RPM	60 to 1800 RPM	
FEED RANGE	.0015 to .054 IPR	.00096 to .289 IPR	.00096 to .289 IPR	.0025 to .100 IPR
FRONT CARRIAGE:				
Longitudinal feed, max.	6"	8"	10"	12"
Swing over cross slide, max.	9½"	12½"	15¼"	17"
Rapid traverse rate	300"	250"	250"	250"
REAR SLIDE:				
Max. stroke	4"	5½"	6½"	8"
LENGTHS BETWEEN CENTERS	15, 24 & 36"	24, 36 & 48"	24, 36, 48 & 60"	36, 60 & 84"

FREE Additional Data

The complete new line of Sundstrand Automatic Lathes includes the Models 4, 8A, 12A and 16 and they range from 5 to 75 HP. Write for complete information on these new machines today. Ask for Bulletins 191.

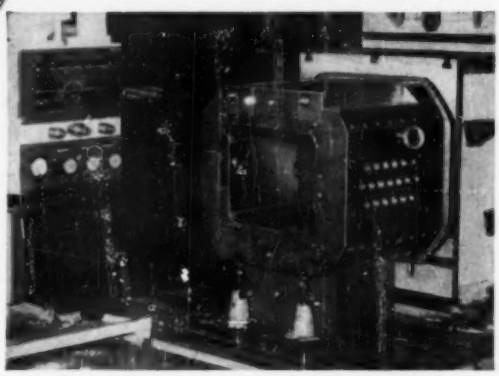
SUNDSTRAND MACHINE TOOL COMPANY

2533 Eleventh St. • Rockford, Ill., U.S.A.

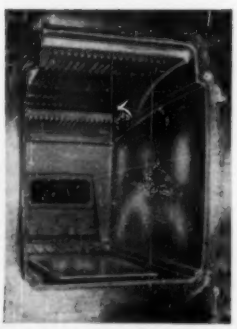
DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

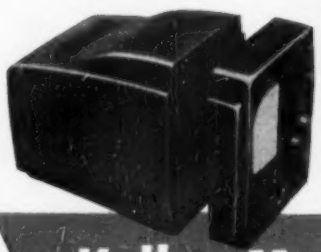
Pratt & Whitney *Kellering* translates General Electric's design-ideas into the smart, sturdy cabinets that house their good-looking TV Sets. The intricate plastic molds that form these cabinets are duplicated accurately from models on the type BG-1 Keller Machine pictured above.

Kellering is heavy-duty, tracer-controlled milling — the most modern, efficient, economical way to accurately and automatically produce dies and molds from wooden or cast models. P&W makes the Keller in all types and sizes for 2-dimensional and 3-dimensional work. It will pay you well to look into *Kellering*. May we send you descriptive Bulletins?



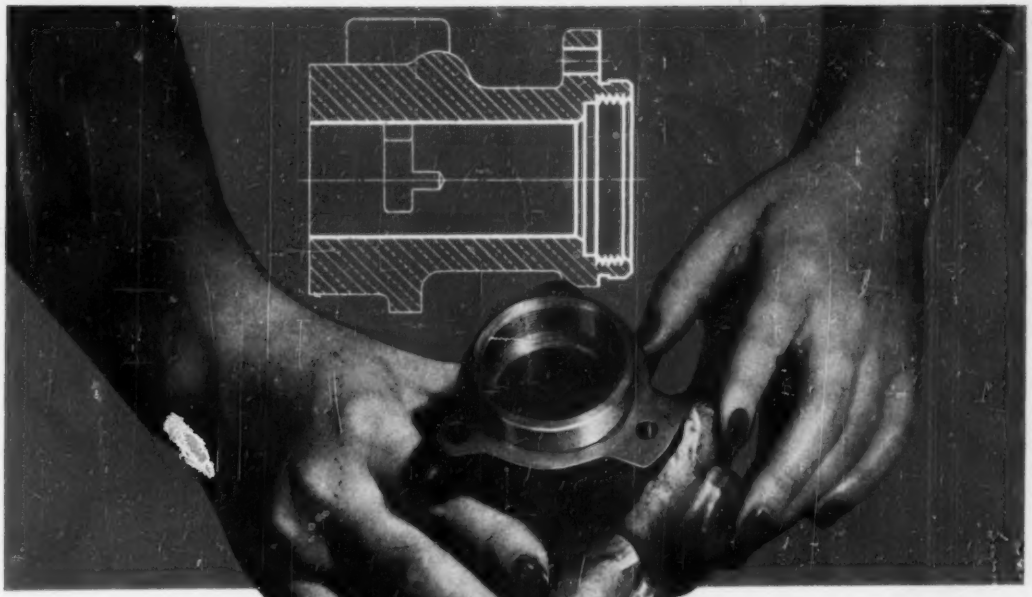
Top: Mold for TV Cabinet set up on the Keller BG-1.
Right: An indication of the precision required by G.E.'s die and mold shop.
Below: Plastic Cabinet for G-E Model 805 TV Set.





Pratt & Whitney
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

Keller Machines

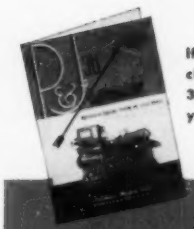


This IS THE RESULT OF P&J PRECISION TOOLING

— a pump housing, just as it comes from the P&J Automatic. Heavy lines in the drawing indicate the 17 exacting operations completed in record time with tungsten carbide P&J-engineered Tooling . . . boring, turning, facing, chamfering, reaming, threading . . . and a clever P&J multiple drill head setup for the three holes in the flanges.

The machine? It's the P&J 3U Speed Flex — smallest of the line of P&J Automatic Turret Lathes — which takes very little floorspace . . . operates with 48 changes of speed from 72 to 1420 rpm for the class of work up to 6" diameter . . . and features fully automatic operation to take fullest advantage of ingenious P&J Tooling.

Even if your work is beyond the 6" class, the skill and know-how of P&J Tooling specialists can work out a profitable tooling setup. Send us a sample part or prints, regardless of size, to prove how P&J Tooling will produce more quality parts with fewer rejects, at lower cost.



If your quantity production is within the 6" class, you will want this Bulletin on the P&J 3U Speed Flex Automatic. Just write for it on your Company letterhead.

Potter & Johnston Company
Pawtucket, R. I.
subsidiary of Pratt & Whitney
Division Niles-Bement-Pond Company

PRODUCTION TOOLING HEADQUARTERS

are businessmen

COLD-BLOODED?

OF COURSE NOT! Literally, their normal body temperature is 98.6—same as laborers, engineers or any other group of people. And, figuratively, they're no more, or no less, cold-blooded—as a group.

We all know unreasonable generalizations can be dangerously false. Common sense and on-the-job experience show us the value of dealing specifically with ideas, problems—and *people*.

Let's not make the big—and costly—mistake, then, of generalizing on religious or racial groups. Adopt and *carry out* these common sense principles:

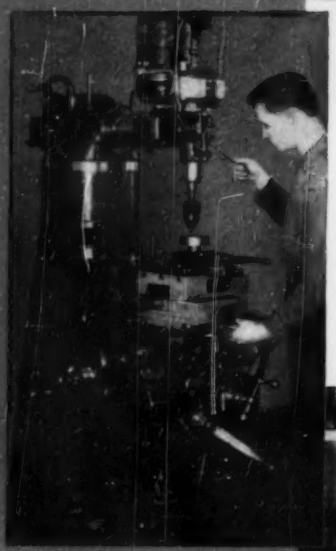
1. Accept—or reject—people on *their individual worth.*
2. Don't listen to or spread rumors against a race or a religion.
3. Speak up, wherever we are, *against* prejudice. Work for understanding.

A PUBLIC SERVICE PROJECT · THE ADVERTISING COUNCIL ·

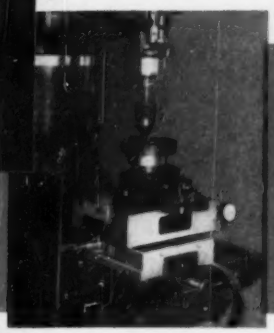
Published in the public interest by:

McGraw-Hill Publications

That Little 4 x 4—
BULLARD SPACER
...does it do a JOB!



Drill spacing with jigs is now proved to be an expensive art compared to the semi-automatic spacing with Bullard Spacer. No need for designing and making jigs for new jobs. Even throw out the old jigs and operational savings will start.



Unique installation of Bullard 4x4 Spacer on a Tool Room Milling machine.

Almoff Machine Company, Long Island City, New York, says, "It saves time on small lots and accurately drills, reams, taps and counterbores. Jigs and layouts are eliminated."

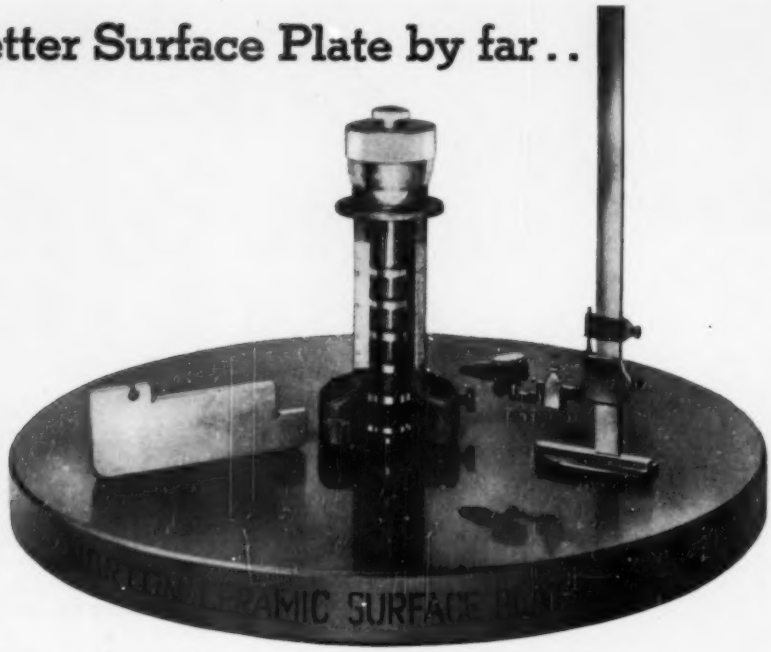
For larger work, the 30 x 20 Spacer on 4', 5' or 6' Radial Drills with Accurate Spindles.

The complete story is told in Bullard's 16 MM. sound film entitled, "Interchangeability Without Jigs."

Write for literature on Bullard Spacers. Two sizes, 30 x 20" and 4 x 4".

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

A Better Surface Plate by far . .



Better by far . . .

because it has so many superior qualities

CHECK THESE IMPORTANT QUALITIES and you'll see how Norton Ceramic Surface Plates will speed up precision checking and cut costs in your plant.

☑ ***LONG LIFE*** is guaranteed for these wear-resistant plates which are made of a material harder than any other type of surface plate. Laboratory and field tests proved wearability was 40 to 1 over best competing type.

☑ ***PRECISION FLATNESS*** of the Norton Ceramic Surface Plate has been found preferable for precision checking operations. Made of a durable and stable material, the ceramic plate stays flat. It will not warp or deform; it will not deflect under load.

☑ ***LESS WEAR OF EXPENSIVE INSTRUMENTS,*** gage blocks and sine bars has proved to be another cost-saving-feature of these ceramic surface plates. The continuously smooth surface allows easy movement of instruments and work across the plate.

☑ ***NON-CORROSIVE.*** The Norton Ceramic Surface Plate will never sweat nor corrode. It does not require greasing or protection from moisture.

☑ ***NON-MAGNETIC*** quality of these ceramic surface plates often proves to be another time-saving feature.

☑ ***LIGHT WEIGHT*** of Norton surface plates permits easy mobility from one checking operation to another. These plates can be finished both sides and their lightness permits easy turning for double utility.

☑ ***BETTER FOR BLUEING.*** The light colored surface of the Norton Ceramic Surface Plate reflects light better for blueing than do dark plates. The special surface texture permits a uniform film to be transferred from plate to work. The blueing mix spreads easily, is moist longer.

☑ ***LOWER MAINTENANCE COSTS*** are obviously the result of using these extremely wear-resistant plates which retain their precision surface finish through years of daily, severe use. The plate is easily cleaned with soap powder and water.

☑ ***CENTER HOLE FOR GAGE SHANK.*** The larger sizes of the Norton Ceramic Surface Plate are made with a center hole which in many checking operations is used to hold the gage shank or center post.

☑ ***FASTER, MORE ACCURATE READINGS*** can be obtained with this ceramic surface plate because the precisely flat and smooth surface permits accurate, duplicate readings to be made quickly.

NORTON COMPANY
Worcester 6, Massachusetts

For price information write for free Bulletin No. 1036

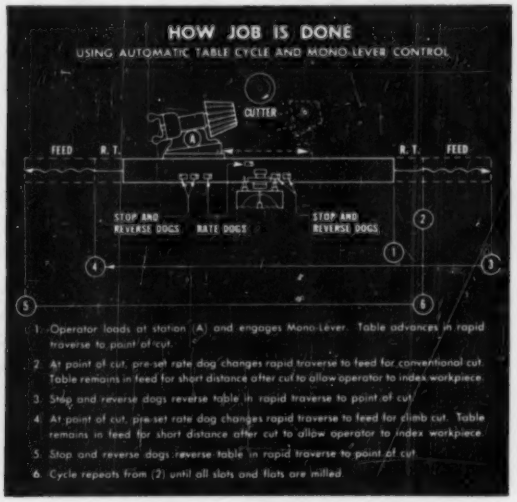
NORTON

CERAMIC SURFACE PLATES

Looking for savings?

96% INCREASE IN PRODUCTION SHOWN ON THIS JOB

Here's modern profit-making in action! This new Kearney & Trecker Model 2H Plain Automatic Cycle milling machine with Mono-Lever control increased production on this complex cast aluminum part 96%.


HOW JOB IS DONE
USING AUTOMATIC TABLE CYCLE AND MONO-LEVER CONTROL
CUTTER
FEED
R. T.
R. T.
FEED
STOP AND REVERSE DOGS
RATE DOGS
STOP AND REVERSE DOGS
1. Operator loads at station (A) and engages Mono-Lever. Table advances in rapid traverse to point of cut.
2. At point of cut, pre-set rate dog changes rapid traverse to feed for conventional cut. Table remains in feed for short distance after cut to allow operator to index workpiece.
3. Stop and reverse dogs reverse table in rapid traverse to point of cut.
4. At point of cut, pre-set rate dog changes rapid traverse to feed for climb cut. Table remains in feed for short distance after cut to allow operator to index workpiece.
5. Stop and reverse dogs reverse table in rapid traverse to point of cut.
6. Cycle repeats from (2) until all slots and flats are milled.

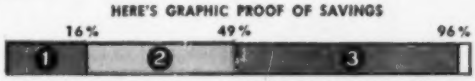
Here's how this big production increase was accomplished. Table cycle was preset to allow for indexing. Backlash eliminated by adjustable table feed screw nut — climb and conventional cuts were done equally well.

COMPARE

Production by old method.

Production gain using a Kearney & Trecker Milling Machine with Mono-Lever Control and Automatic Table Cycle.

HERE'S GRAPHIC PROOF OF SAVINGS



1. 16%—The minimum over-all savings reported from any job when done on a Kearney & Trecker Milling Machine with Mono-Lever Control and Automatic Table Cycle.
2. 16%-49% — The *majority* of over-all savings from jobs done on these machines fall here.
3. 49%-96%—Under favorable conditions, several jobs done on these machines have shown savings like this!

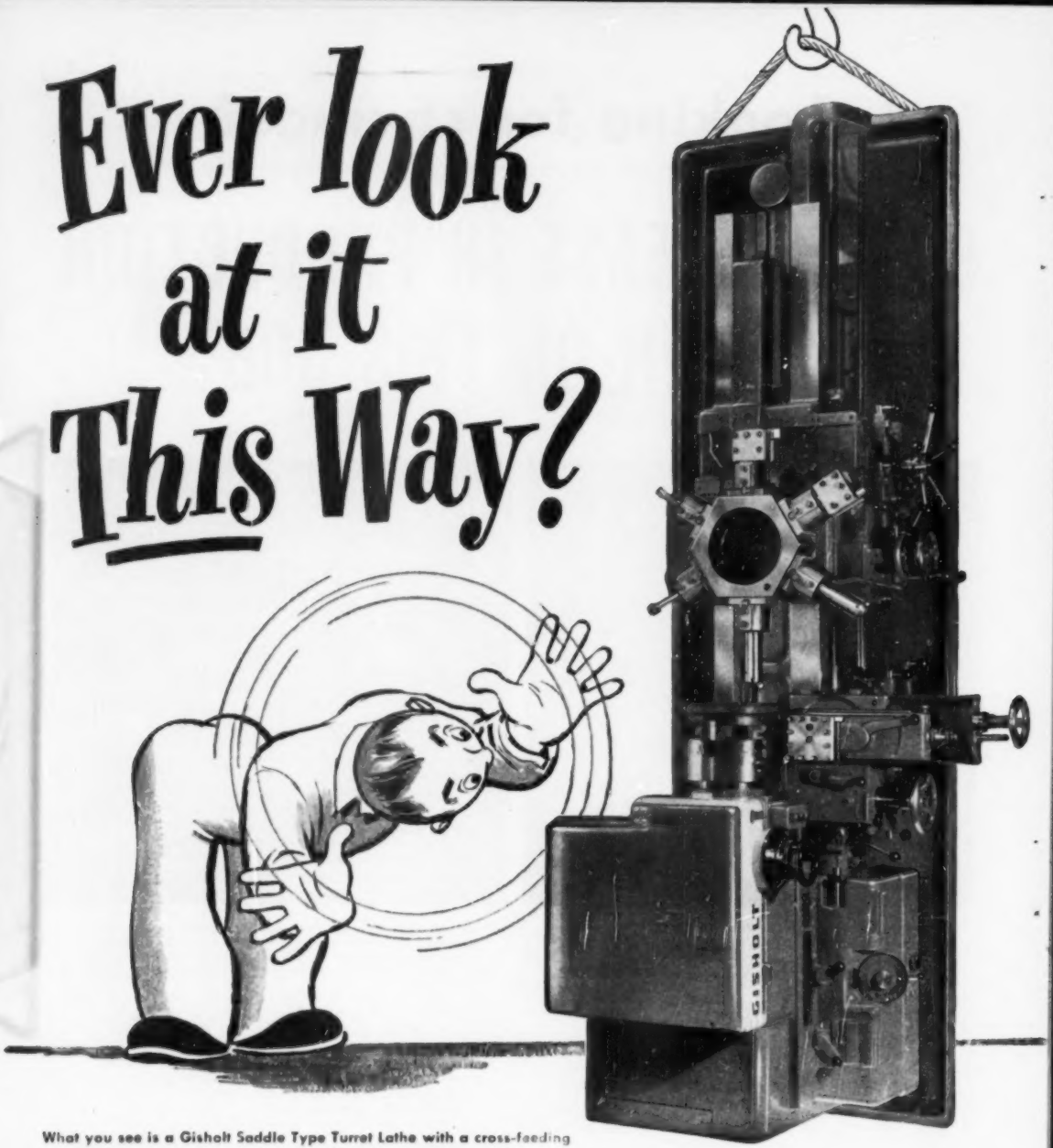
YES, here is a positive answer to cutting high shop costs — Kearney & Trecker milling machines with Mono-Lever control and Automatic Table Cycle.

The job data shown here, plus the bar graph, at the left, shows what other users have done AND *what you can expect* . . . savings of 16% to 96% on most milling operations.

Contact us or our nearest representative today. Get the facts on how Kearney & Trecker milling machines with Mono-Lever control and Automatic Table Cycle can cut your costs, increase your savings. No obligation. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Ever look at it This Way?



What you see is a Gisholt Saddle Type Turret Lathe with a cross-feeding turret and set on end to look like a Side Head Vertical Boring Mill.

This Turret Lathe is ideal for varied work on small lots. The cross-feeding hexagon turret will bore, face, recess, thread or otherwise finish the interior of the workpiece. The square turret on the side carriage will meanwhile face, turn or chamfer the OD. When necessary, you can pilot the hexagon turret tools or make other use of the hollow spindle. And all this is done with simple, inexpensive, easily set up tools.

Investigate the five basic sizes of the Gisholt Saddle Type Turret Lathe. Each is available with the money-saving cross-feeding turret.

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

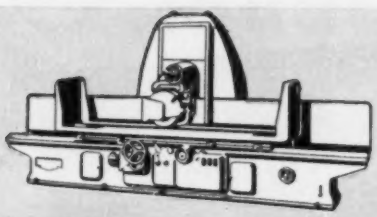
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

MATTISON GRINDERS

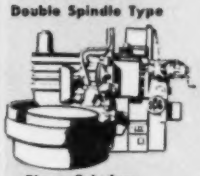
If its a Flat Surface to Grind
There's a Mattison to Grind it.



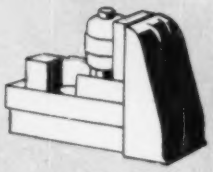
Precision Surface Grinders
Horizontal Spindle

Disc Grinders,
Double Spindle Type

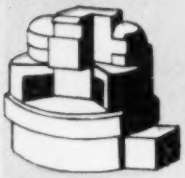
Vertical Spindle
Disc Grinders



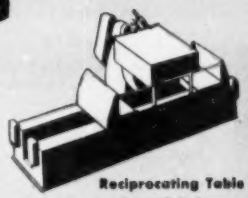
Plano Grinders,
Rotary Table Type



Rotary Table
Surface Grinders

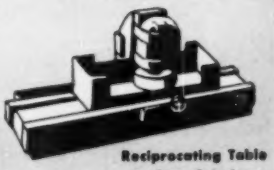


Automatic Rotary
Surface Grinders



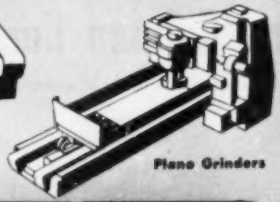
Reciprocating Table
Face Grinders

Disc Grinders,
Single Spindle Type



Reciprocating Table
Surface Grinders
Vertical Spindle

Face Grinders,
Traveling Wheel



Plano Grinders

● With the addition of the production grinding machinery formerly made by the Hanchett Manufacturing Company, Mattison now is in a position to work with you on all your surface, face and disc grinding problems. These machines are made in various types to handle a wide range of work. Experienced fixture engineers are available to give you best production efficiency with Mattison Machines.

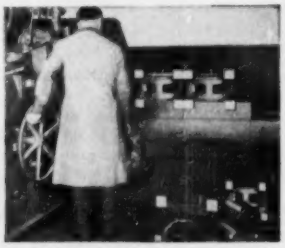
For any flat grinding, ask for our recommendations on the proper method and machine for your job. No obligation, of course.

For catalog on all machines, ask for free copy of general bulletin.

200 Transmission Case surfaces ground per hour on Mattison (Hanchett Type) Rotary Automatic Grinder. A special 8-station mechanical fixture permits one operator to grind each end of this large 35 lb. casting, flat and parallel. Stock removal .050".

Grinding cast-iron cams — 6" diameter, 1½" thick — stock removal, each side .030". Production, 120 surfaces per hour on Mattison (Hanchett Type) Rotary Surface Grinder.

2½ ton machine-bed ground in 60% less time on Mattison Precision Surface Grinder than required by former method, hand scraping.



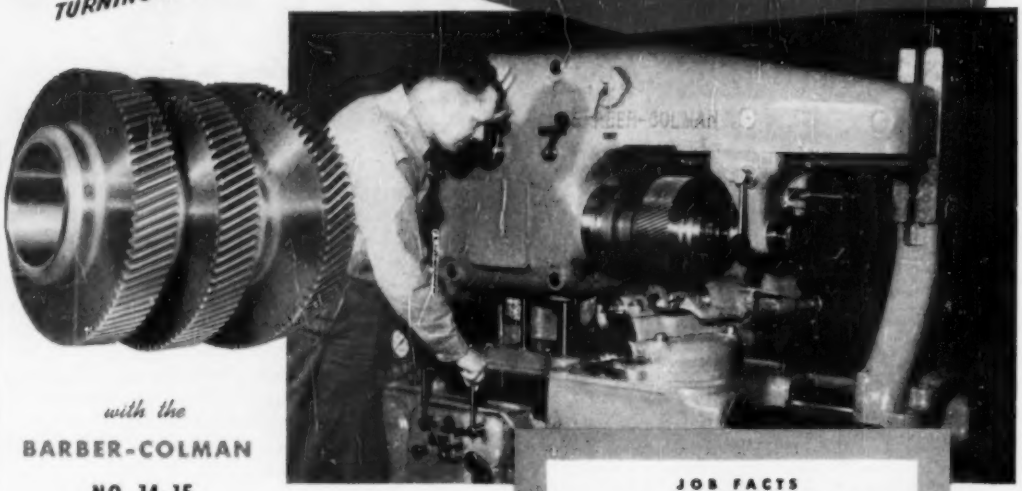
Grinding feet of motor frames from rough castings and welded assemblies on Mattison (Hanchett Type) Face Grinder.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

CUTS HOBBING TIME FROM 33 TO 13 MINUTES PER GEAR



with the

BARBER-COLMAN

NO. 14-15

HOBBING MACHINE

Monarch Machine Tool Company has reduced hobbing time on these 8 pitch helical lathe gears by 61%, using the Barber-Colman No. 14-15 Hobbing Machine and ground Class A *"Multithread"* Hobs. Gears are climb-hobbed, leaving .015" stock for finishing and holding non-adjacent tooth spacing error within .001"-.002".

As a result of the installation of this No. 14-15, large diameter *"Multithread"* hobs are used at faster feeds, giving greater production. Better work finish is obtained and the overall job improvement has appreciably reduced the number of hobbing machines required for a given output. For stepped-up production with a maximum of accuracy and ease of operation, Barber-Colman No. 14-15 Hobbing Machines offer automatic cycling with hydraulic movement and clamping. Results show better, faster output with less work and a minimum of non-productive machine time. Write our engineering department for estimates.

JOB FACTS

Operation — Climb hob 8 pitch Helical gears, 11-1/2" dia., 84 teeth
Material — NE 8749
Hobs — *"Multithreads"*, 8 pitch, 5-1/2" x 4" x taper bore
Feed — .060" per rev. of work
Speed — 90 SFM
Hobbing Time — 13 min. per gear
Accuracy — Non-adjacent spacing held within .001"-.002"

Barber-Colman Company

GENERAL OFFICES AND PLANT, 6112 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

METHODS ENGINEERS

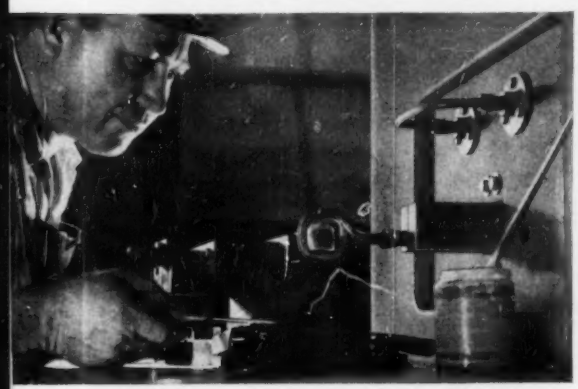
This new release on the No. 14-15 Hobbing Machine contains typical examples of actual field performance. Write for copy of Bulletin No. 6102

BARBER COLMAN

Induction Heaters Are Ideal For Job Lots

PRODUCTION RATES RAISED as much as 500% when this 20-kw unit took over the processing of 11 parts (from driving pinions to trimmer blades) at a southern machinery company. Only a switch of work coils is needed to change jobs. Hardening, brazing and annealing are all done on the one machine. Takes only a minute to switch from job to job.

NO SKILL NEEDED to operate the Allis-Chalmers induction heater on this annealing job according to the midwest manufacturer now using the unit. The same heater is also used for brazing fittings onto cases — with only a change of work coils. Annealing of cases takes nine seconds. Brazing two fittings at a time takes 15 seconds.



15 SECONDS is all it takes this big user of cutting tools to braze tungsten carbide tips to tool bits. A relatively unskilled operator does the job well. And it takes him less than a minute to change the work coil to handle a different size tool. The simplicity of Allis-Chalmers induction heaters makes them ideal for job or production work.

NO SPECIAL TRAINING needed to change work coils — no additional output transformers or capacitors needed. Allis-Chalmers induction heater is ideal for either production or job work. Unit shown does hardening, brazing, annealing, and soldering of small runs and individual pieces. No special work-handling equipment is required.

GET EXPERT ENGINEERING HELP! Allis-Chalmers engineers and methods experts will completely process samples of your work . . . suggest and design simple, effective work handling equipment, and quote per piece production and equipment costs. Standard ratings: 1, 2, 10, 20, 50, 75, 100, and 200 kw.

Check with your nearby Allis-Chalmers representative regarding this offer — or write direct.

ALLIS-CHALMERS

A-2827

ALLIS-CHALMERS, 999A SO. 70 ST.
MILWAUKEE, WIS.

Please send descriptive bulletin 15B6431A.

Name.....

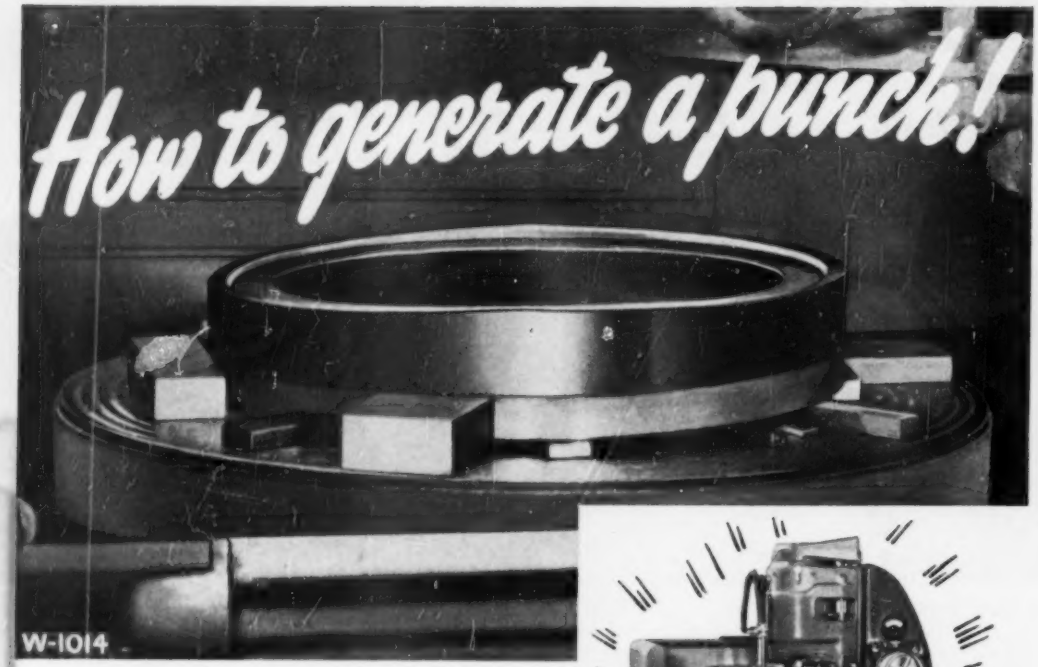
Title.....

Company.....

Address.....

City..... State.....

How to generate a punch!



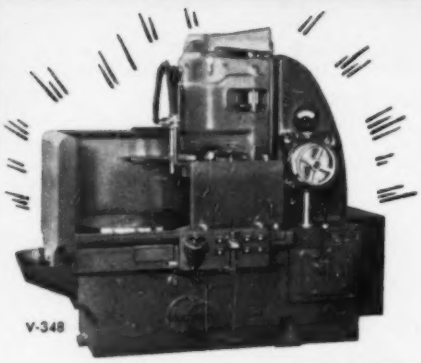
... Put it on the BLANCHARD

Obviously this is no ordinary surface grinding job—and obviously the Blanchard No. 18, with tilting wheelhead column, is the right machine for the job.

Duplicate circumferential and radial shear reliefs are generated in two set-ups on this 24 13/16" punch. Resharpening operation takes approximately 45 minutes.

Each portion is ground by the following method. The punch is centered on the magnetic chuck, and wedged to raise one side to obtain proper circumferential shear. The wheelhead is then tilted to a predetermined angle. A normal grinding operation generates the specified shape on one half of circle.

Blanchard is in a unique position to help you solve surface grinding problems that may look difficult or impossible —by methods that prove easy and profitable. Send samples or prints for free production estimates.



NO. 18 BLANCHARD SURFACE GRINDER

Send for free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD **THE BLANCHARD MACHINE COMPANY**
64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

Faster Tapping
on every job...
WITH THIS COMPLETE
MORSE LINE

Yes, Morse Taps cut far faster because they're precision-cut themselves . . . give you smoother, stronger threads without clogging or damage. And that's because Morse takes the time and pains to make taps with a full measure of quality.

Whatever your material and job-conditions, Morse has the right tap for you . . . cut thread or ground thread . . . standard or special. Ask your Morse-Franchised Distributor to recommend the type and size of Morse Taps that will be most effective in speeding up your operation and cutting your costs. *Call him today.*

SPECIFY *Electrolized*
FOR LONGER LIFE

Sold Exclusively Through Morse-Franchised Distributors

Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
A DIVISION OF VAN NORMAN COMPANY

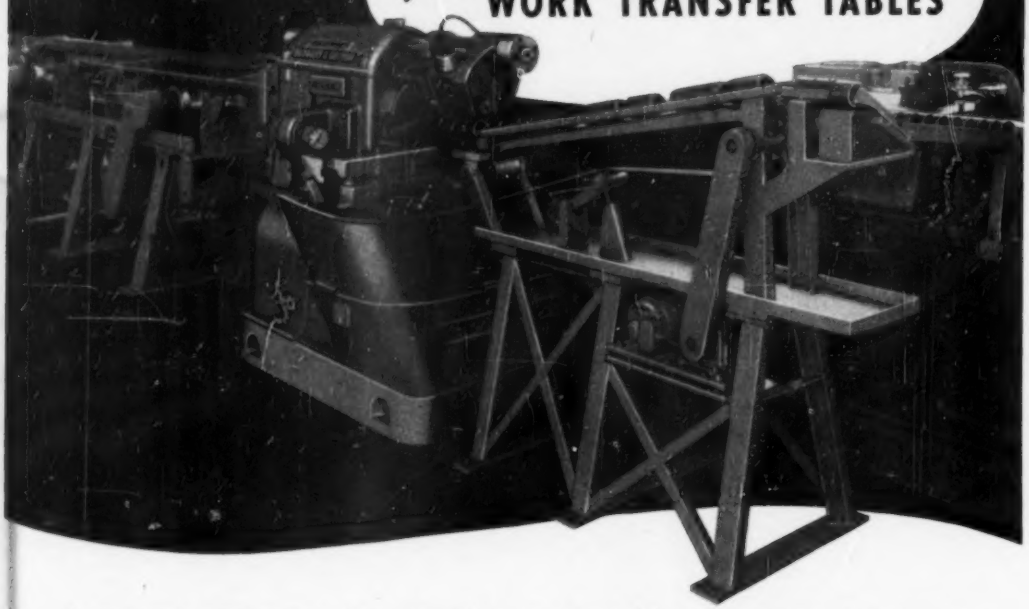
BRANCH WAREHOUSES: NEW YORK • DETROIT • CHICAGO • SAN FRANCISCO

PAGES
MISSING

Cost of making CONDUIT COUPLING BLANKS greatly reduced by

Automatic

LOADING and WORK TRANSFER TABLES



AS PICTURED ABOVE, 16 to 24 foot lengths of pipe are being automatically roller fed, from a Bardons & Oliver Automatic Loading Table, into a Bardons & Oliver No. 34 Hydralectric Cut-off Machine, which automatically outside chamfers both ends and cuts off the conduit coupling blanks.

After being cut off, the conduit coupling blanks are automatically delivered, by a Bardons & Oliver motor driven Transfer Table . . . to a second operation machine, for the internal chamfering of both ends.

From the time of dropping a bundle of pipe onto the Loading Table, to when the finished conduit couplings roll out, no human hand touches the work. Only one operator is required for the complete layout.

Bardons & Oliver Automatic Loading Tables and Transfer Tables can be furnished to handle a wide variety of parts made from tubing or pipe, so we suggest that you call on us for our engineering advice and assistance.

We build a full line of ram and saddle type turret lathes, as well as a complete line of cut off machines.

BARDONS & OLIVER, INC.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO

A section of the special, air-conditioned, temperature-controlled department at Brown & Sharpe, where all finishing operations of Johansson Gage Blocks are performed.

To assure excellent manufacturing conditions, the department is divided into three sections; one for finish grinding, one for rough lapping and one for finished lapping and final inspection.

IF your products must meet close standards of accuracy, they'll warrant the use of measuring equipment periodically checked against Brown & Sharpe Jo-Blocks. With this protection, finished work meets specified tolerances *consistently*. Errors caused by poorly set measuring tools or worn gages will be caught before they can do serious harm.

The ever-growing use of Jo-Blocks demonstrates their industry-wide importance . . . as master laboratory standards for setting and verifying work standards; as actual working gages; and as positive guides for laying out and setting up work with great accuracy.

Brown & Sharpe Jo-Blocks are made in 3 guaranteed accuracy standards; .000002", .000004" and .000008" . . . sold as single blocks or in sets. Write for new illustrated booklet on Jo-Blocks and Accessories. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

Johansson
BROWN & SHARPE

We urge buying through the Distributor

BROWN & SHARPE

This is another of the "HUNDREDS OF JOBS" which can be done only on a MARVEL Band Saw!

MARVEL BAND SAW saved these two 4400 lb. castings

Two sand cores washed out when these giant 4400 pound steel connecting rods were cast, resulting in solid eye ends without gaps. Then came the $64 question—how to machine out the 1½" slots in the longitudinal center of the eyes which were 22" high and had a wall thickness of 6½".

The Ernest J. Nelson Iron Works of San Francisco, did this "impossible" job easily, quickly and economically, without special tooling, on a standard Model #8M/2 MARVEL Band Saw. Two cuts were made in each rod in two hours per cut with tool cost of $3.06 per rod. The tool was a MARVEL B9-10 Band Saw Blade.

Every tool room, machine shop and maintenance department needs a MARVEL Series 8 Universal Band Saw—not only for innumerable everyday jobs but for the occasional "trick" operations, where its utmost versatility will save many headaches and dollars.

WRITE FOR CATALOG

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

These exclusive MARVEL Features made this job easy.

1. Large, T-slotted work table.
2. Blade feeds into work vertically; work always stationary.
3. Power-pressure feed.
4. Automatic Blade tension.
5. Built-in coolant system.
6. Large capacity.

ARMSTRONG-BLUM MFG. CO.

5700 BLOOMINGDALE AVENUE CHICAGO 39, ILLINOIS

SEND FOR CATALOG No.

NEW . . . IN MEDIUM PRICED LATHES
Extra-Long Bed Lengths

Sebastian
GEARED HEAD
20" LATHES

20" x 20' LATHE
200" BETWEEN CENTERS
20¼" SWING

20" SEBASTIAN LATHE
Standard & Gap Types

AVAILABLE BED LENGTH	DISTANCE BETWEEN CENTERS
6'	32"
8'	56"
10'	80"
12'	104"
14'	128"
16'	152"
18'	176"
20'	200"

HANDLE LONG, SLENDER WORK PIECES
Have Same Capacity as Heavy Duty Lathes

Cut both initial and maintenance costs with this "KING Engineered" medium priced Sebastian Lathe. Handles a full range of work, including long, lightweight pieces ordinarily machined on expensive heavy duty lathes.

Outstanding features include all-geared, 8-speed headstock with Timken Bearings . . . reverse in apron for feeds . . . motor fitted in cabinet leg.

SEND FOR THESE FREE CATALOGS!

Illustrated Sebastian Catalogs S-1 (Standard Lathes) and S-101 (Special Lathes—Gap, Clutch & Brake, etc.) give complete description and detailed specifications. See for yourself why the modern Sebastian is today's outstanding value!

American Steel Foundries

KING MACHINE TOOL DIVISION
CINCINNATI 29, OHIO
Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

Two Machines in One!

FOSDICK SENSITIVE RADIAL

It's a Sensitive It's a Radial

● To fully appreciate the wide application of this versatile machine you should see one of these Fosdick Sensitive Radials in operation.

It has all the high speed features of a Sensitive Drill plus the heavy construction, rigidity and flexibility of a Radial.

Here are a few of its many advanced features—

- 12" diameter one piece column construction.
- Fixed arm which swings 360° around column.
- Adjustable table which swings 360° and may be positioned to suit any drilling job.
- Table moved by power or hand.
- Tool ejector.
- New patented semi-automatic tapping control.
- Fluorescent tube for lighting entire table.

Illustrated is a Fosdick Sensitive Radial installation at East Alton, Illinois. The wide acceptance of this highly versatile machine tool is largely the result of its adaptability to such a large number of drilling operations in so many different kinds of work pieces.

If you want to cash in on the savings offered in this moderately priced all purpose sensitive radial, put one to work in your shop.

For specific details as to design construction and application, write for the Fosdick Sensitive Radial Bulletin S. R. A.

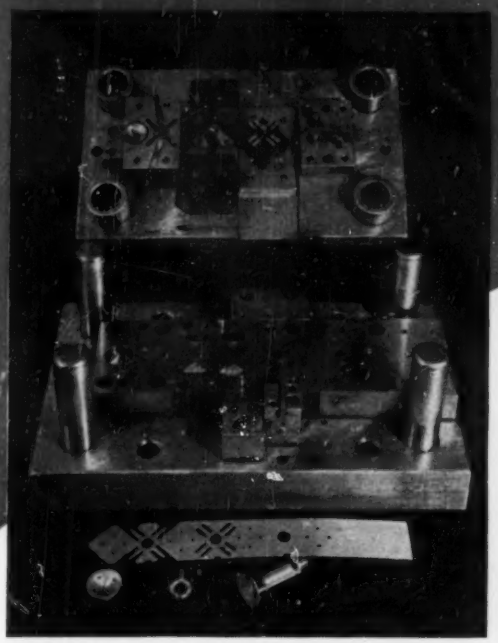
FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

A-H5

(5 PCT CHROME AIR-HARDENING)

A Toolroom Favorite on 5 counts

1. **Air-hardening for safety.**
2. **Good wear-resistance.**
3. **Good toughness.**
4. **Excellent resistance to deformation.**
5. **Easy to machine.**

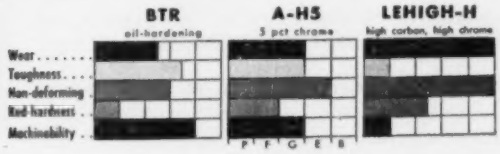


"A-H5 always meets or exceeds our expectations . . ."

This comment comes from the chief engineer of Day and Night Division, Affiliated Gas Equipment, Inc., in Monrovia, California. This company makes a modern line of gas, space and water heaters for home and commercial uses. The die shown is used to pierce, blank and form burner canopies from .0235-in. stainless-steel strip. With all its parts made of A-H5 except the punches (they are Lehigh H), this progressive die is still going strong after producing several hundred thousand pieces, samples of which are shown in the foreground.

There's plenty of versatility in this 5 pct chrome, air-hardening tool steel. And it's economical, too, often replacing more expensive grades.

A-H5 is a general-purpose steel that fits in between the standard oil-hardening steels (such as Bethlehem's BTR) and the high-carbon, high-chrome tool steels like Lehigh H (another Bethlehem champion). Here's a quick comparison of the properties of all three:



(Poor, Fair, Good, Excellent, Best)

Use A-H5 for a variety of dies, punches, blanking tools, cold-forming dies, master tools, gages, and the like. Give it a thorough trial and you'll be sold on having it in your toolroom to stay. Let the nearest Bethlehem sales office or tool-steel distributor give you complete information. Quick delivery from our mill depot or local distributor's stock.

HEAT-TREATMENT OF A-H5

Typical Analysis:	C	Mn	Cr	Mo	V
	1.00	0.60	5.25	1.10	0.25

Annealing: Pack, heat to 1650 F, slow furnace-cool, Brinell 212 max

Preheating: 1200 to 1250 F, prior to hardening

Hardening: 1775 F, air-quench

Tempering: 350 to 400 F, Rockwell C 60 to 62

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation

Export Distributor:
Bethlehem Steel Export Corporation

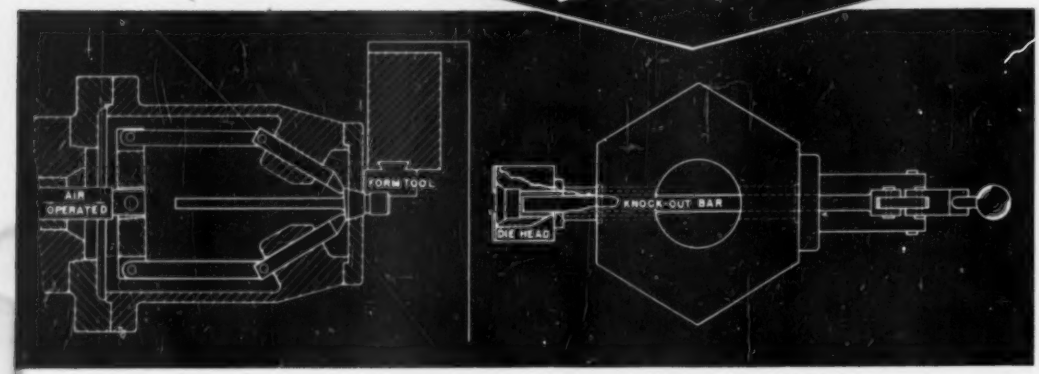
BETHLEHEM STEEL

SUPERSONIC TESTED

Bethlehem Tool Steel

YOU CAN USE IDEAS

Like This

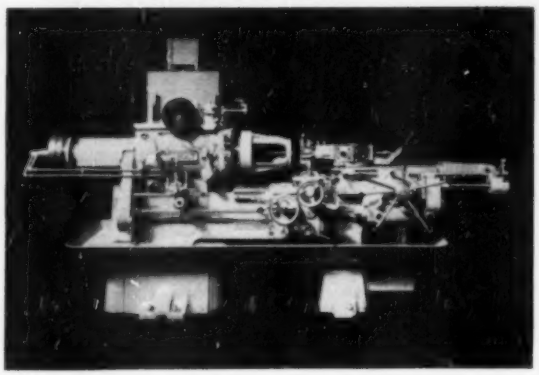


WITH GISHOLT TURRET LATHES

Here's a turbine blade job. It is a tough job to hold because not only are there a number of different blades, each of different length, but the work must be located and held against a tapered surface. It requires a special fixture. An air-operated plunger through the spindle forces the taper against the locating seat on the fixture, holding all sizes firmly.

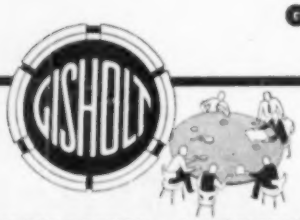
The machining is done on the shank end. It must be turned and faced and necked for thread relief. Form tools on the rear of the cross slide handle all this in a single pass. Threading is done from the turret and a hand-operated knock-out bar loosens the blade from the fixture after the threading is completed. Production is more than adequate to meet the contract requirements.

This kind of investment pays off handsomely. If you are looking for practical, cost-cutting ideas, why not let Gisholt engineers help you. They have been specialists in turret lathe work for over 60 years.



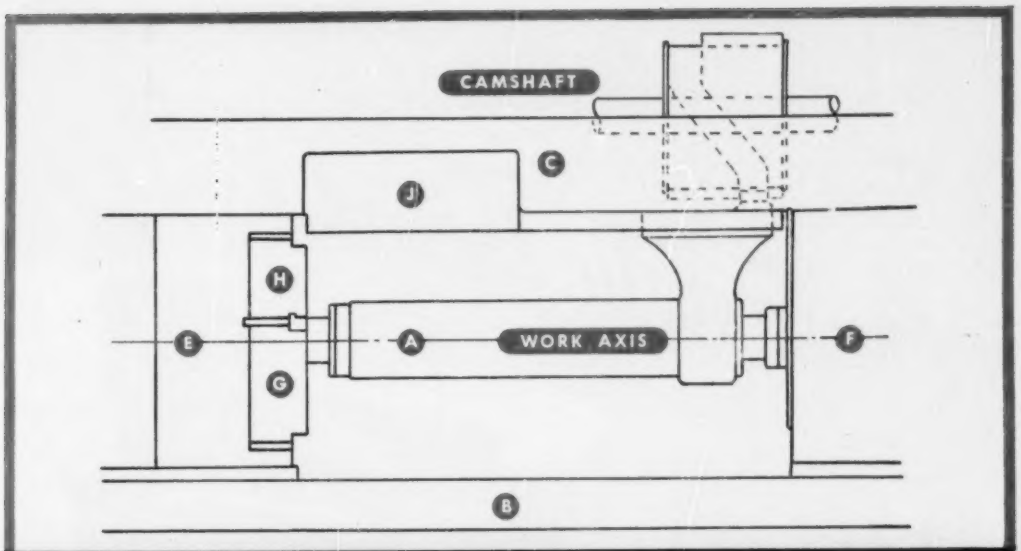
Gisholt lathes are ideal for high speed work of this kind. With hydraulic spindle control, the Gisholt Speed Selector, and many other automatic features, operating time and effort are reduced to a minimum. Ask for literature.

GISHOLT MACHINE COMPANY
MADISON 10, WISCONSIN



THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



THE *good* THAT MEN DO

The horizontal design Tooling Area, shown above, is a contribution by Frank L. Cone to the improvement of the Multiple Spindle Automatic Bar Machine that will live long after him. The advantages, stated below, are made possible by the machine's Overhead Camshaft. Specific data invites comparison.

THE TOOLING AREA OF THE CONOMATIC (1½" Six Spindle):

1. **Handles longer work than can be handled by the tooling area of any other "automatic."**

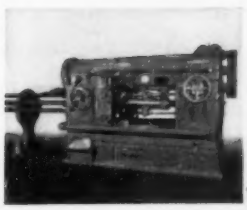
   The length of the Tooling Area is 46 5/16 ins., which permits standard machining operations on work up to 18 ins. in length from the face of the cut-off tool.

2. **Is more strongly supported by the machine frame than is the tooling area of any other "automatic."**

   The stocky Uprights, E and F, which are shorter than those of other "automatics," are securely bolted to — and held between — the Top Bed, C, and Base, B, which are larger and heavier than such members of other "automatics." *The Uprights are 22" high. The Top Bed is 8" high, 23" wide and 103¼" long. It weighs 1232 lbs. The Base is 33¾" high, 46" wide and 110" long. It weighs 6655 lbs.*

3. **Provides more Tooling positions than does any other "automatic."**

   The Main End Slide, A, has 6 positions. The Main Cross Slides, G and H, front and rear, have 6, and the Auxiliary Cross Slide, J, front and rear, are 2 more, which make a total of 14.



Buyer's Comparison Chart will guide you to full information

A Comparison of ALL Automatics is in Favor of Cone

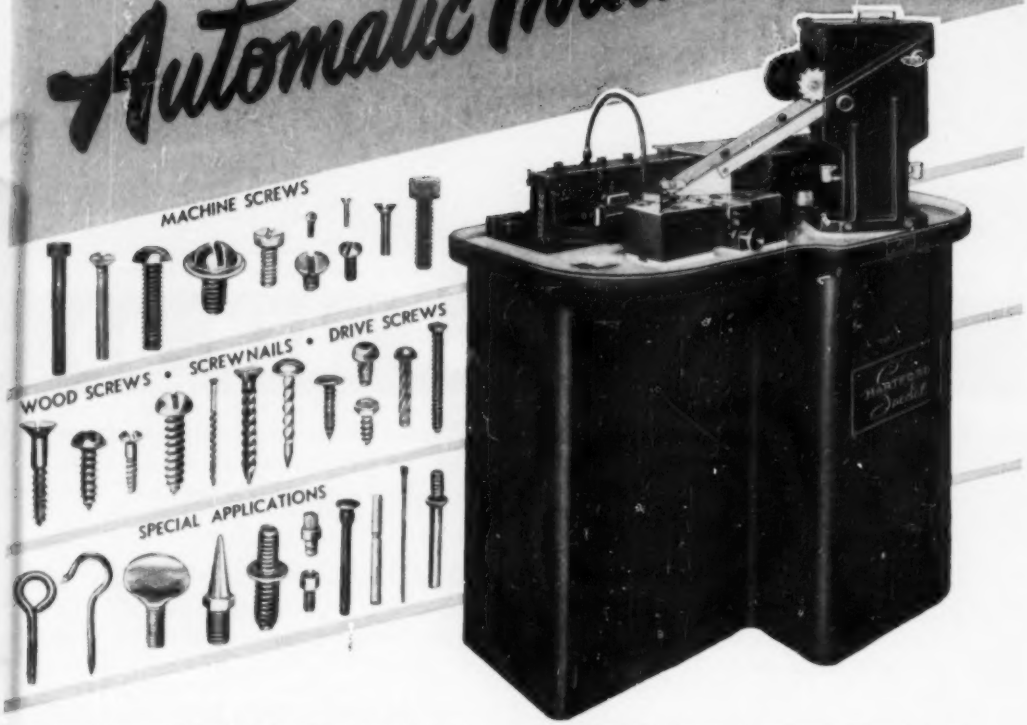
Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

LOW COST — HIGH PRODUCTION

HARTFORD Special

Automatic Thread Roller



This Automatic Thread Roller is designed to solve standard and special thread rolling problems on small size screws from .086" to .190" in diameter with thread length capacity from ⅛" to 1½", rolling consistently to Class 3 Thread Fit. Careful engineering and rugged construction make it capable of continued high production runs with startling economy.

The "Hartford Special" Automatic Thread Roller incorporates such outstanding features as Completely Automatic Feed, Filtered Lubrication System, "Table Top" Working Level, Vibration-Free Operation, plus many more.

Our engineering staff is always available to help you work out your thread rolling problems. Write now for complete information.

HARTFORD Special

Automatic Drilling and Tapping Machinery • Swaging Machines
Die Polishing Machines • Contract Machine Work • Gears • Cams
"Super-Spacers" • "Four-Point" Milling Vises • "V-Block" Milling Fixtures

THE HARTFORD SPECIAL MACHINERY CO.
287 Homestead Ave., Hartford 5, Conn.

Please send me free Bulletin TR-100 describing your Automatic Thread Roller.

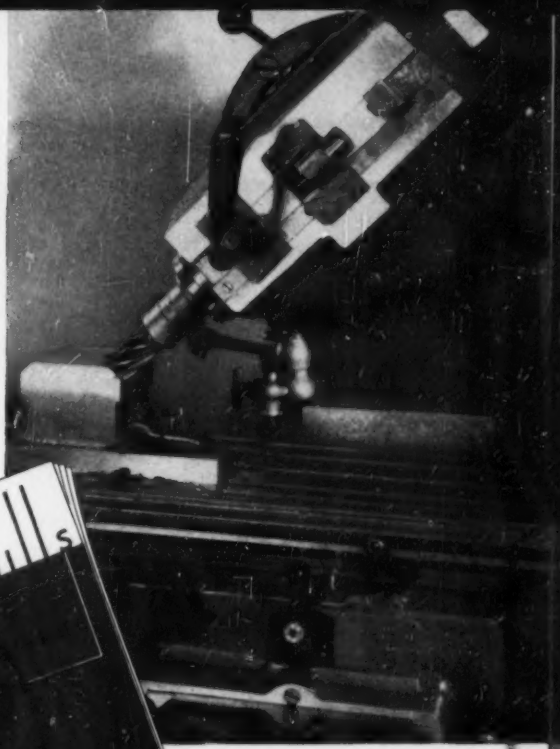
Name _____ Pos. _____

Company _____

Address _____

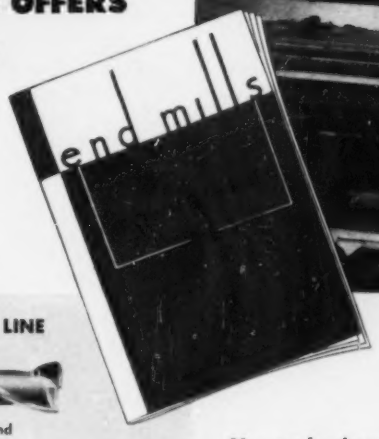
1 City _____ Zone _____ State _____

For more profitable end milling



BROWN & SHARPE OFFERS

quality end mills in styles and sizes to meet every requirement



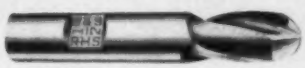
LATEST ADDITIONS TO THE LINE

Long, Two-Flute Fast Spiral Single-End

Fast Spiral Double-End with 3/16" Straight Shank

Extra Long, Fast Spiral Single-End

Long, Two-Flute Fast Spiral Double-End with 3/16" Straight Shank



Ball End, Two-Flute Fast Spiral Single-End

Long, Fast Spiral Double-End with 3/16" Straight Shank

Two-Flute Fast Spiral Double-End with 3/16" Straight Shank

Long, Fast Spiral Single-End

You can be choosey in the selection of Brown & Sharpe End Mills because there are 18 styles with a complete range of sizes in the line. The closer you match end mills to your needs, the faster, more efficiently they will cut and the less power you'll need for cutting.

Eight recently-added types of end mills are shown at the left. These and all other Brown & Sharpe end mills have design and construction features that will help you improve your milling operations. For example, the fast spiral angle of the teeth of many end mills provides extremely fast cutting action. Also, styles are available for use in the Brown & Sharpe Patented Cam Lock Adapter which provides positive drive and maximum speed and convenience in changing mills.

Get better acquainted with this quality line of end mills. Send for complete catalog containing specifications and prices. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

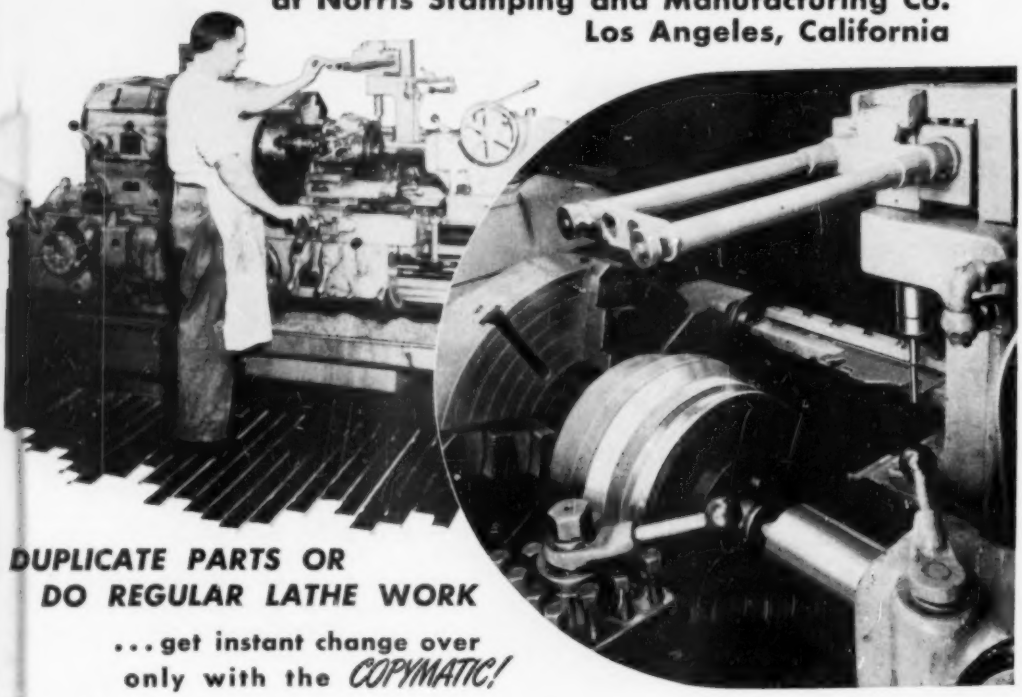
We urge buying through the Distributor

BROWN & SHARPE CUTTERS B·S

LODGE & SHIPLEY *COPYMATIC* LATHE

SAVES 50%

production time over former methods at Norris Stamping and Manufacturing Co. Los Angeles, California



DUPLICATE PARTS OR DO REGULAR LATHE WORK

... get instant change over only with the *COPYMATIC!*

This startling reduction in production time is not just a Lodge & Shipley shop test. It's actually the daily performance record of the Copymatic in the plant of Norris Stamping and Manufacturing Co., Los Angeles, California.

The Copymatic not only cuts time in half for Norris, but this lathe machines their high chrome —high carbon auto rim rolls with unbelievable hardness of Rockwell C 62!

This evidence of increased production and greater power capacity is just part of the Copymatic story. Changeover instantly from automatic tracer controlled duplication to regular lathe work—a feature only the Copymatic offers. No attachments or gadgets to put on or remove.

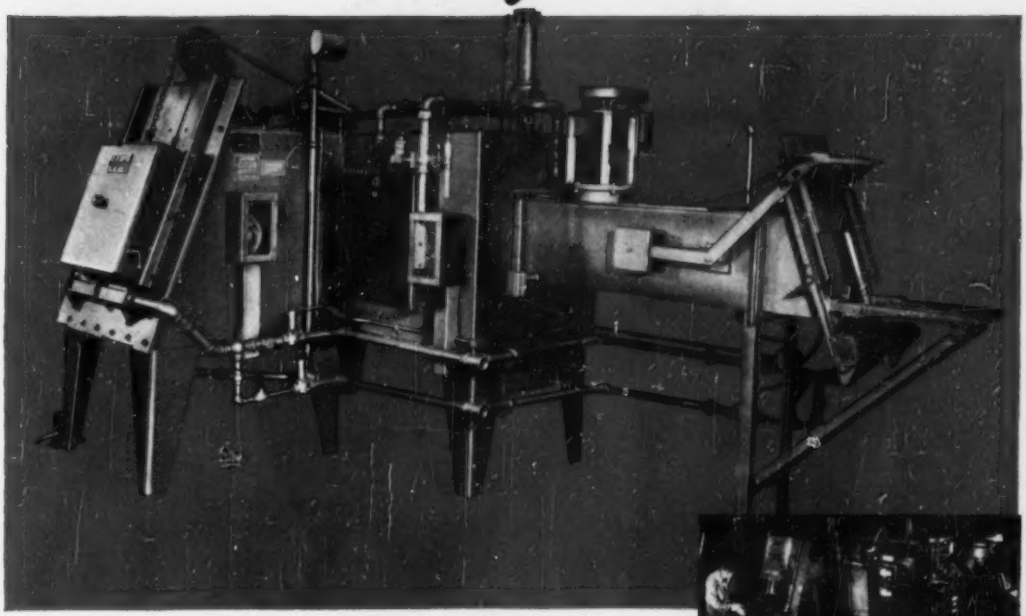
Using either flat or round templates, the COPYMATIC reproduces square shoulder faces, grinding necks, tapers in both directions, chamfers and curved contours with a high degree of accuracy. Often, the need for a special template is eliminated . . . the first piece of a lot may be produced by standard lathe operation, inserted between the template supports and used to produce the rest of the lot automatically.

The COPYMATIC offers the convenience and speed of hydraulic duplication, with all the versatility of the Lodge & Shipley "Model X" Engine Lathe. This double adaptability of the COPYMATIC takes it out of the special purpose machine class, makes it a profitable producer for any size shop. For additional details write for Bulletin No. 675.

THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

Announcing a new process for heat treating High-Speed Steels!



THE LINDBERG "L-TYPE" FURNACE

This revolutionary new furnace is designed to harden precision high-speed tools completely scale free and without discoloration. It is ideal for tools with fine cutting edges that cannot be ground or cleaned after hardening.

Unique in construction and appearance—preheat, high heat and quench are combined in one unit—designed for complete atmosphere protection from start to finish. The "L-Type" Furnace is the result of three years of research and a year and a half of testing in the Lindberg Commercial Heat Treating Plants. It is the FIRST MAJOR ADVANCE in hardening high-speed steels since the introduction of atmosphere treating.

COMPLETELY ELIMINATES

- . . . cracking of tools due to quenching strains
- . . . removing scale by sandblasting or grinding
- . . . drastic dimensional changes during processing
- . . . oil quench tank and oil cooling system
- . . . washing quench oil from work
- . . . decarburization and carburization troubles

OFFERS MANY ADVANTAGES

Improved surface appearance . . . Increased tool life . . . Decreased heating costs . . . Decreased atmosphere costs . . . Improved working conditions . . . Not limited to high speed steels.

Write for Bulletin No. 220 for full details.

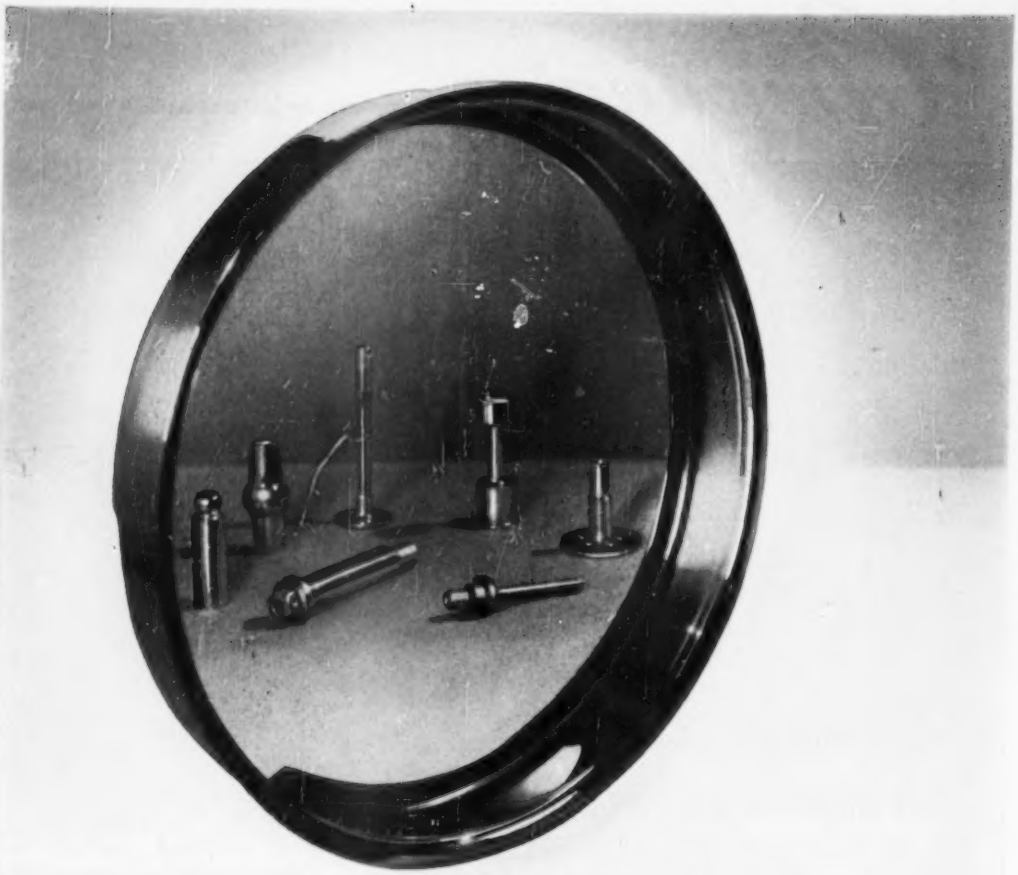
LOS ANGELES, CALIFORNIA

ST. LOUIS, MISSOURI

CHICAGO, ILLINOIS

LINDBERG ENGINEERING COMPANY 2445 W. Hubbard Street, Chicago 12, Illinois

LINDBERG FURNACES



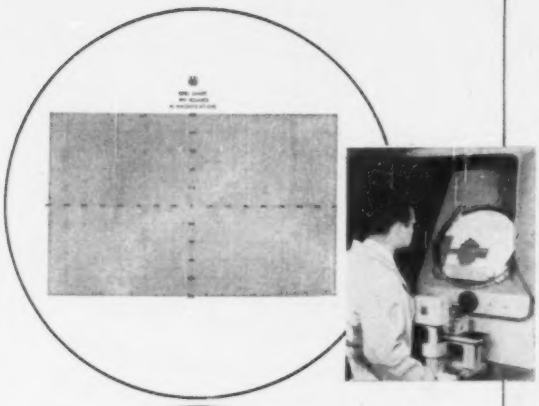
THE HARDENED AND PRECISION GROUND PARTS

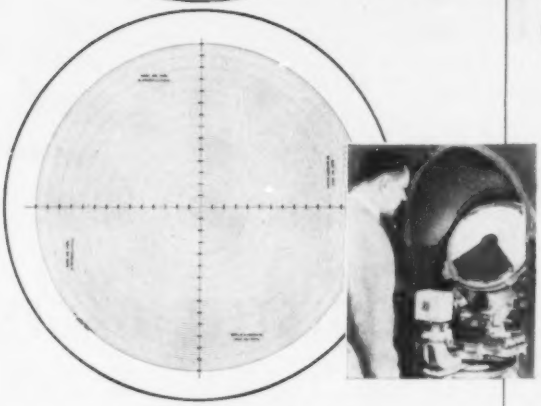
You're Looking For

With the fine surface finishes . . . close tolerances . . . carefully controlled heat treatment . . . so necessary in governing the quality of your finished product. When Allied produces such parts for you, you can be sure they are in strict accordance with your specifications. Allied is equipped to manufacture hardened and ground parts in high volume and, whether of intricate or simple design, they are produced economically and on time. Send us your part prints. We will submit quotations promptly.

ALLIED PRODUCTS CORPORATION
DEPARTMENT 50
12605 BURT ROAD • DETROIT 23, MICHIGAN

HARDENED AND PRECISION GROUND PARTS • STANDARD CAP SCREWS • SPECIAL COLD FORGED PARTS SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST • JIGS • FIXTURES • STEAM-HEATED PLASTIC MOLDS • SPECIAL PRODUCTION TOOLS • R-B INTERCHANGEABLE PUNCHES AND DIES • DIE MAKERS' SUPPLIES





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With these charts many ***Difficult Inspection Operations Become Routine Jobs.***

They are ***Invaluable Accessories*** that ***Add*** to the ***Economy*** and ***Versatility*** of the ***Comparator.***

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Made To Precision Standards Of Accuracy established during more than ***30 Years Of Specialized Optical Experience.***

Write to Dept. 710 for your copy of our New Chart Catalog No. 471.

Optical Comparator Division

JONES & LAMSON ®

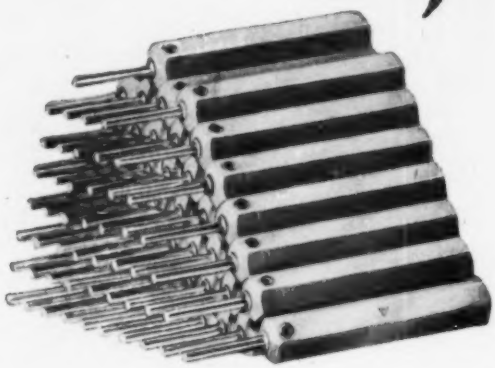
MACHINE COMPANY

Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

Van Keuren

CARBOLOY
Wire Type
PLUG GAGES
are the right answer



1 VK CARBOLOY=50 TOOLSTEEL GAGES

After considerable experimentation with various wear resistant materials, we have chosen Carboloy as being the most practical, durable and economical. Carboloy does not flake or chip easily and is quite suitable for wire type plug gages as small as .020" in diameter.

Wire Type Plug Gages were originated by the Van Keuren Co. in 1925 and are now recognized as the most economical gages for measuring small holes. The original wire type plug gages were made of tool steel—High Speed steel doubled gage life. VK Chromium Plate gave 5 times the life, and VK Carboloy 50 times the life of tool steel gaging units. All of these materials are still in use and have their particular applications.

VK Carboloy gaging units are made in sizes from .020" to .500" diameter. They are made only in the wire type design because this is by far the most economical plug gage. In cases where it is desired to use VK Carboloy wire type Go units with existing No Go taper insert unit, special handles can be furnished for this purpose.

Van Keuren Wire Type Plug Gages assure longer lasting precision and lower gage cost, because the entire 2" length of gage can be used. When the end of the wire becomes worn, it is ground off. The wire type unit is securely held in the unit by a split bushing and a headless set screw.

VK Carboloy Wire Type Plug Gages are made to Class B accuracy, plus .00005" minus, .00000" on the Go unit and plus or minus .000025" on the No Go unit. Closer or wider tolerances can be supplied if desired.

On your next order Specify VK Wire Type Plug Gages; VK Carboloy for long runs because of the enormous saving in gage cost; VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that the parts will be within the specified limits; VK Tool Steel—High Speed Steel—Precision Chromium for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

CATALOG AND HANDBOOK No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies free upon request.

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

31st YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Trianges • Carbaloy Plug Gages • Carbaloy Measuring Wires

These 7 Great Features Add Up To LONG V-BELT LIFE

1 *Powerful Cord Structure* built up of hard-twisted, high tensile strength cords, impregnated with live rubber compound to prevent chafing and heating.

2 *Thick, Resilient Cushion* of rubber supports cord structure at correct pitch line . . . absorbs shocks . . . helps dissipate heat.

3 *Tough, double-wrapped cover* of long staple fibres, bias cut for elasticity and impregnated with rubber. Protects cords . . . seals out dust, grit, moisture.

4 *Extra Stiffening Plies* of heavy fabric and rubber help keep the belt square in the groove.

5 *Precision Molded And Cured* in accurate steel dies. Gives belt the *straight* sides necessary to provide the bulging gripping action that all V-belts need.

6 *Every Belt Carefully Weighed* and inspected during construction. Assures perfect balance and uniformity.

7 *Accurate Set Matching* . . . Every finished belt measured while running under load. *Texrope* multiple V-belts are matched in sets to assure uniform load on each belt.

COMPLETE V-BELT SERVICE

Get everything you need for your V-belt drives . . . V-belts, standard and variable pitch sheaves and speed changers . . . from one reliable source. 144 page *Texrope* Pre-engineered Drive manual covers 90% of requirements. Get your copy today from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956. Also in Sweet's.

ALLIS-CHALMERS, 999A SO. 70 ST. MILWAUKEE, WIS.

Texrope and *Super-7* are Allis-Chalmers trademarks.

Super-7 *Texrope* V-Belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

A-2836

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

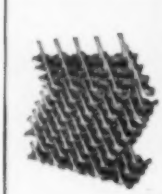
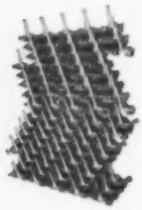
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

ALLIS-CHALMERS

MONA•MATIC or Multiple Tooling Methods ..WHICH?

LET'S TALK PRODUCTION!

MULTIPLE TOOL	MONA•MATIC
	

	Multiple Tool Automatics (Battery of Four)	Mona-Matics (Battery of Two)
Production	**120/hour**	**160/hour**
Cutting Tools	Cemented Carbide	Cemented Carbide
No. of Tools	40	4
Cost of Tools (including one replacement set)	$4220	$187
Setup Time	28-30 hours	46 minutes
Total Horsepower	80-120	40
Floor Space	150-200% more than Mona-Matics	
Subsequent Grinding Operations		50% less time than multiple tool

Would you rather get 160—or 120 parts per hour? It's just as simple as that.

One man, operating two Mona-Matics, can produce 160 of these steering knuckles every hour. This same man tending *four* multiple tool automatics, gets only 120 parts an hour!

But bear in mind that production is not the whole story of the Mona-Matic's outstanding ability to cut your costs. You'll save on setup time, on tooling costs, on accuracy, on power consumption and on floor space, too. For the full facts on how Monarch's famous Mona-Matics will outperform any ordinary multiple tool machining method, write for Bulletin 1804.

COMPARATIVE CASE STUDY

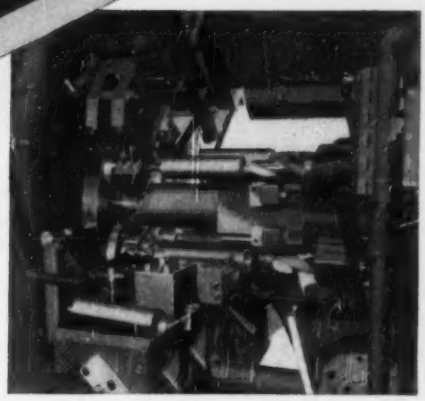
Part—Steering Knuckle,
SAE 1045, turned section—5 3/8" long, 3/4" to 3" diameter

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL CO. Sidney, Ohio

What does extra-heavy drilling cost you?



Acme-Gridleys will outperform old-fashioned methods every time—*and at less cost.* Sturdy basic machine construction and positive, direct camming permits pushing large diameter drills at heavy feeds while holding close concentricity—the .002 limit on the job illustrated is typical.

Unless your present machining methods can match this performance, you owe it to yourself to investigate what modern Acme-Gridley Automatics can do for *your* cost figures. May we give you more information? Ask for new bulletin T.P.-44, showing Top Performance on 44 jobs.

JOB FACTS

PART: Steel Shaft
SIZE: 10" x 2¾" Diam.
MATERIAL: B 1112 Steel Bar Stock
MACHINE: Acme-Gridley 2⅝" RB-4 Spindle Automatic Bar Machine
OPERATIONS: 12
TOLERANCE: .002 Concentricity on All Machined Diameters
MACHINING TIME: 1 Minute, 30 Seconds

The NATIONAL ACME CO.

170 EAST 131st STREET · CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics · Single Spindle Automatics · Thread Rolling Machines · Automatic Threading Dies and Taps · The Chronolog · Limit, Motor Starter and Control Station Switches · Counters · Solenoids · Centrifuges · Contract Manufacturing

These concave harrow discs are ground and polished in one lightning-fast, dollar-saving operation with RESINALL METALITE Cloth Belts and backstand idlers. Typical of the versatility of this profitable combination is the way these discs are given a spun finish by the action of the abrasive belt, which cuts and at the same time revolves the disc on its ball bearing fixture. Removing the scale and polishing takes only 18 to 35 seconds of actual sanding time!

RESINALL METALITE Cloth Belts finish these and many other pieces faster and with less cost because they're resin-bonded to withstand hot, heavy-duty work. The special bond won't get soft and tacky and the belt definitely resists loading and glazing. RESINALL METALITE Cloth Belts cut sharp and fast all the way.

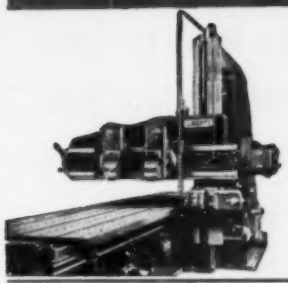
Behr-Manning abrasive belts are slashing finishing costs everywhere. Whatever the material or shape of your products, it will pay you to check with our field engineer in your area. A new bulletin, just off the press, tells the whole story. Write for it today.

BEHR-MANNING®

BEHR-MANNING
TROY, N.Y.

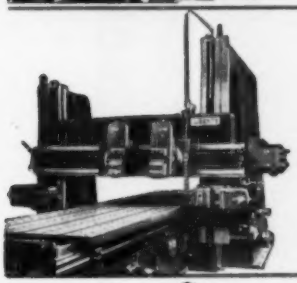
Use NORTON® abrasives Sharpening Stones

LIBERTY BUILDS 3 great PLANERS



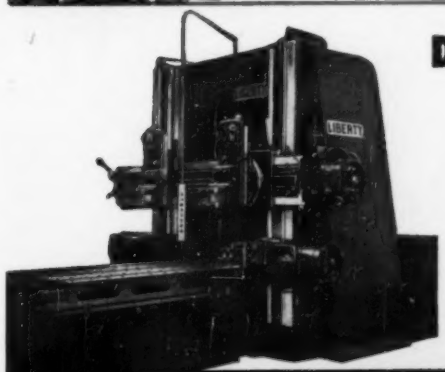
OPEN SIDE

For shops handling work of variable widths. Wide-faced housing and motorized clamp give rigidity for heavy roughing cuts and finishing. Dual control; electric feeds; rapid traverse to all Heads in all directions.



CONVERTIBLE

For exceptional rigidity on variable widths. Two, three or four heads. Offset heads permit closest approach of tools. Double balanced driving gear and pinions. Extreme accuracy.



DOUBLE HOUSING

For rapid production combined with accuracy. Two, three or four heads. Extremely rigid; handles production work with maximum cutting feeds and speeds. Table pulled into tool. Electric clamping and dual control for ease of operation; high production.

Write for catalog giving complete details.

All lengths, 24″ x 24″ wide and larger.

LIBERTY PLANERS, INC.

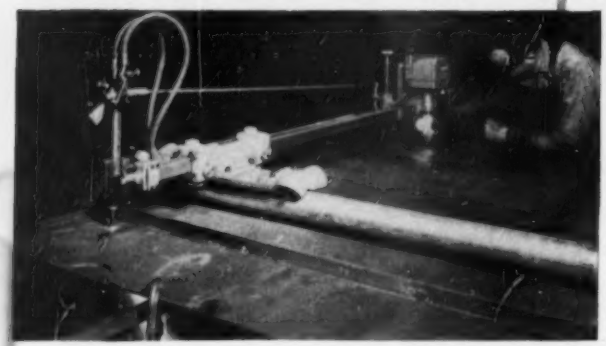
HAMILTON, OHIO

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 W. MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities

"We can't say enough about Airco's NEW No. 3 Monograph . . . its portability, accuracy and shape cutting versatility make it a MUST for every metal working shop..."

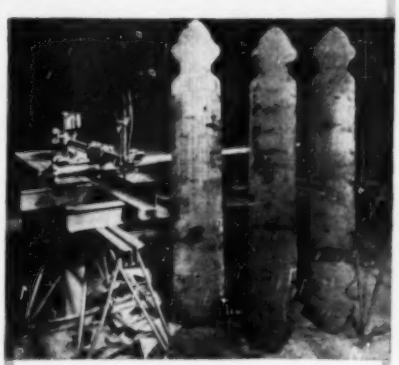
Says Mr. J. C. Hustad, President
Hustad Company, Minneapolis, Minn.



Used for machine gas cutting of special structural shapes at Hustad, the Airco No. 3 Monograph has more than proved its ability to meet the demand for straight line, circle and bevel cutting, with an extremely high degree of accuracy.

Further, with a cutting area of 32 inches by 56 inches, it gives excellent results in cutting most any steel shape up to 8 inches thick . . . and a 6-foot 8-inch rail can be added, extending the cutting area indefinitely.

This NEW machine is the lowest priced machine of its type in the field (only $695, including a manual tracing device, torch, tip, tubular rail, hose and carrying case). Also, it is portable—the machine itself weighs but 110 lbs. and the tubular rail 35 lbs. The entire unit is packed in a carrying case which can be conveniently handled by two men.



SPECIAL TRIAL OFFER
(Good in Continental U.S.A. Only)

If you would like to try this machine for two weeks *in your own shop on your own work*, just drop a letter to your nearest Airco office or authorized Airco dealer and they will advise you how a shop-trial can be arranged . . . or, if you would like a descriptive folder (ADC-660) they will be glad to send you a copy.

This shows a clevis for a steel mill guide cut from 6" plate—note the smoothness of the cut, reducing considerably machining cost and time.

AIRCO **AIR REDUCTION**
Offices in Principal Cities

Headquarters for Oxygen, Acetylene and Other Gases . . . Calcium Carbide
Gas Cutting Machines . . . Gas Welding and Cutting Apparatus and
Supplies . . . Arc Welders, Electrodes and Accessories.

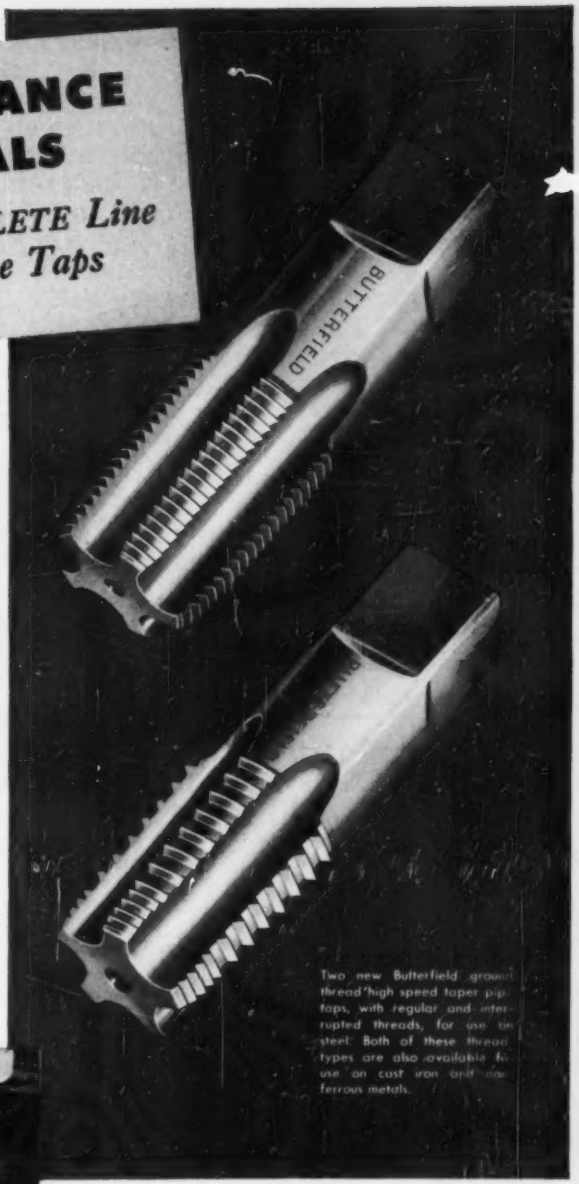
TOP PERFORMANCE IN ALL METALS

With Butterfield's COMPLETE Line of 100% Inspected Pipe Taps

Working with some of the largest industrial users, Butterfield has achieved distinct advancements in the performance of pipe taps. Notably, in the development of a special type for steel and another for cast iron and non-ferrous metals — both of which have been thoroughly proved in actual use.

Among other Butterfield contributions in the pipe-tap field you'll find a full range of dryseal-form taps, taper and straight, with ground threads. Eliminating the annoyance of compounds, their Butterfield-engineered accuracy is your assurance of faster, easier, lower-cost sealing of joints and fittings.

Butterfield taper pipe taps are available with ground or cut threads, regular or interrupted, also regular straight, in high speed steel and with regular taper or straight threads in carbon steel — *all individually inspected* . . . See your nearby Butterfield distributor for prompt service. Union Twist Drill Company, BUTTERFIELD DIVISION, Derby Line, Vermont. *In Canada:* Rock Island, Quebec.



Two new Butterfield ground thread high speed taper pipe taps, with regular and interrupted threads, for use on steel. Both of these thread types are also available for use on cast iron and non-ferrous metals.

Checking pitch diameters with wires, by the pressure method. Some of the specialized equipment used in Butterfield's 100% inspection.

BUTTERFIELD

THE 100% INSPECTED TOOLS

Every Tool Individually Inspected

TAPS • DIES • REAMERS • SCREW PLATES

AO Panoram Goggles

Workers look at things Broadly and Safely in PANORAM...

goggle of Wide-Angle Vision!

When eye protection against flying particles from any direction and *wide* lateral vision are required on the job, the Panoram with its exceptional seeing area is the choice of workers and safety directors everywhere. What's more, it may be worn over personal glasses with the greatest of comfort. Available with clear or green frames, clear or green lenses. Your nearest AO Safety Products Representative has this popular goggle.

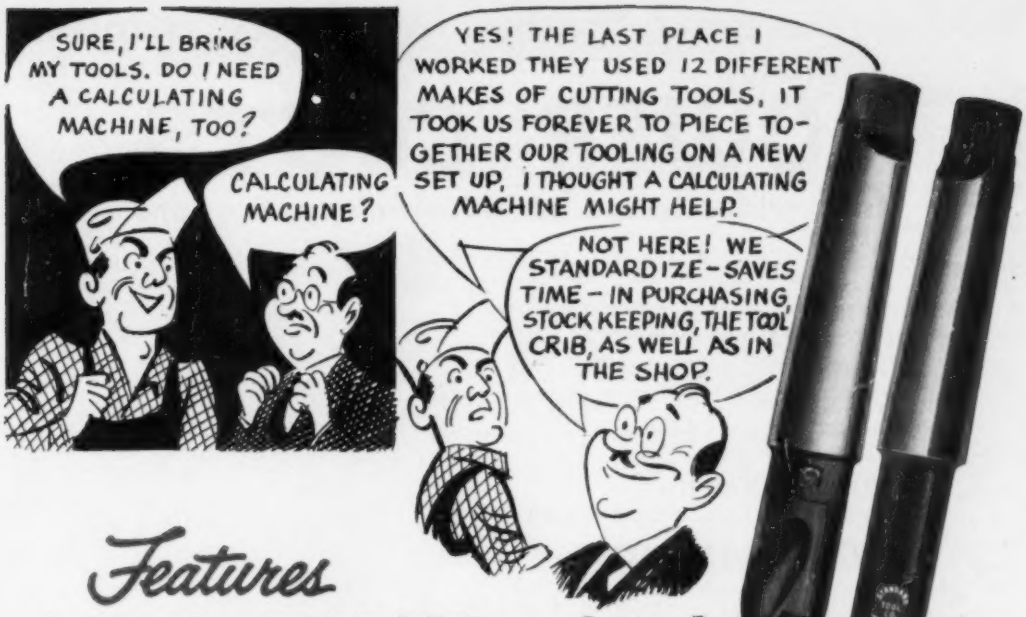
Quick Facts

- Plastic eyecups conform closely, smoothly to face for maximum safety and comfort. Perforations at top and bottom give ample ventilation—reduce possibility of fogging.
- Bridge is comfortable floating saddle type—fits without pressure.
- Lenses are shatter-resistant acetate—easily replaceable. Order green lenses when ultra-violet radiations and glare are hazards.

Available with rubber cushions at extra cost as illustrated.

American Optical
SAFETY PRODUCTS DIVISION

Southbridge, Massachusetts • Branches in Principal Cities


SURE, I'LL BRING MY TOOLS. DO I NEED A CALCULATING MACHINE, TOO?
CALCULATING MACHINE?
YES! THE LAST PLACE I WORKED THEY USED 12 DIFFERENT MAKES OF CUTTING TOOLS, IT TOOK US FOREVER TO PIECE TOGETHER OUR TOOLING ON A NEW SET UP, I THOUGHT A CALCULATING MACHINE MIGHT HELP.
NOT HERE! WE STANDARDIZE - SAVES TIME - IN PURCHASING, STOCK KEEPING, THE TOOL CRIB, AS WELL AS IN THE SHOP.

Features of Standard Shield Brand Tools

1. Foremost Quality—In design—workmanship—material. **2. Complete Line**—One reliable source of supply for drills, reamers, taps, dies, milling cutters, end mills, hobs, counterbores, and special tools. **3. Complete Service Stock**—Over 10,000 items regularly carried in factory stock. **4. Nation-wide Availability**—Stocked and supplied by leading Mill Supply Distributors coast to coast. **5. Men Who Know Their Business**—Our service staff has the advantage of 68 years of accumulated experience in solving tough problems.

Standardize on Shield Brand Tools for uniform cost reducing performance

STANDARD TOOL CO.

Successor to The Standard Tool Company

CLEVELAND 4, OHIO

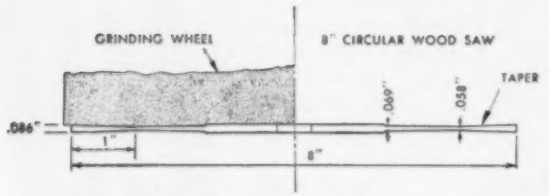
New York • Detroit • Chicago

THE STANDARD LINE: Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools

Adaptable New Thompson Surface Grinders

LOWER COSTS

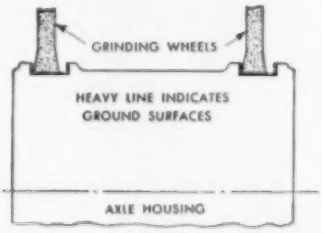
In a wider range of industrial applications



TRUFORMING MACHINE GRINDS CIRCULAR WOOD SAWS

IN 300% LESS TIME

This Thompson Circular Saw Truforming Machine grinds 8 inch high carbon steel wood saws in 2½ minutes. Formerly this job required 2 operations and 8 to 10 minutes on a circular single chuck grinder. Machine is available in 6 to 12 inch and 6 to 16 inch sizes.

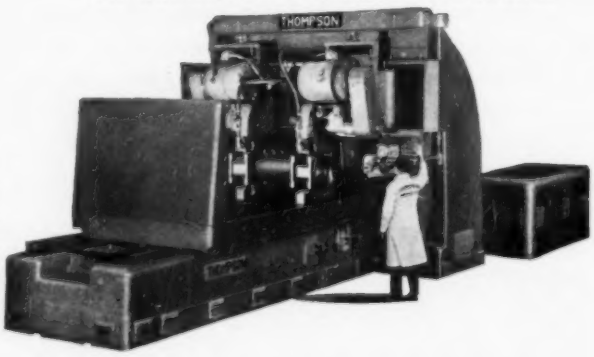


Thompson Hydrail Grinder (widest surface grinder built) reduces finishing time on massive diesel locomotive bearing housings and grinds to a tolerance of .0008" over 72" x 120" area. Machine illustrated is 72" x 36" x 120". In other industrial applications can sharpen large dies eliminating stripping down and assuring that all surfaces will be in correct relation. Horizontal or vertical wheel heads or both available. *Write today for details or other information concerning possible application of Thompson Surface Grinders in your production work.*

HYDRAIL GRINDER DOES

3-DAY JOB IN 2 HOURS

ON LOCOMOTIVE BEARING HOUSINGS



The only manufacturer of a complete range of heavy duty and light duty surface and contour grinders for industry.

Thompson SURFACE Grinders

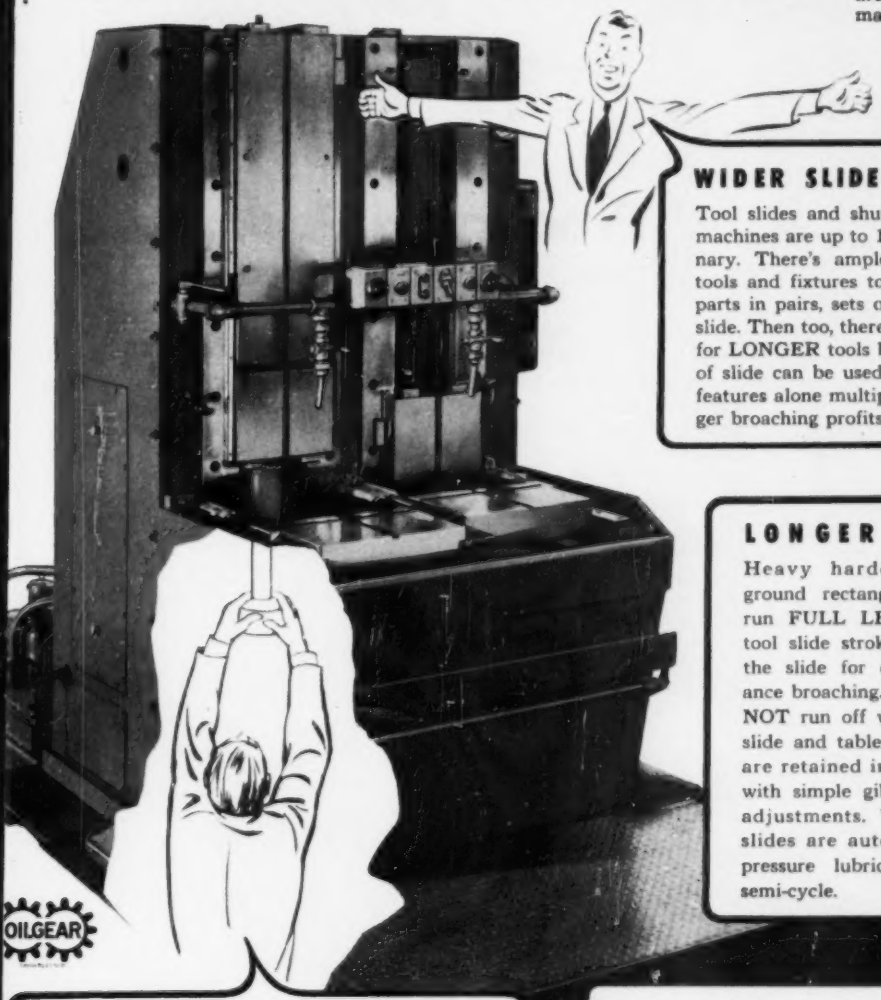
The Thompson Grinder Company, Springfield, Ohio

Copyright 1949—The Thompson Grinder Co.

...IN OILGEAR SURFACE BROACHING MACHINES

When you purchase an Oilgear Surface Broaching Machine you get a big bonus of features which are not incorporated in other machines.

Consider these important features carefully for if you don't get Oilgear *features* you can't get Oilgear *performance*.



WIDER SLIDES AND TABLES

Tool slides and shuttle tables on Oilgear machines are up to 130% wider than ordinary. There's ample room for grouping tools and fixtures to broach two or more parts in pairs, sets or sequence on **EACH** slide. Then too, there's up to 4" more room for **LONGER** tools because the full stroke of slide can be used for broaching. These features alone multiply production for bigger broaching profits.

LONGER WAYS

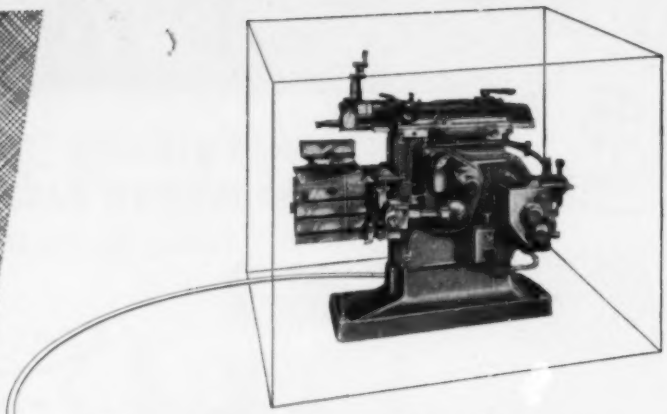
Heavy hardened and ground rectangular ways run **FULL LENGTH** of tool slide stroke to guide the slide for close tolerance broaching. Slides **DO NOT** run off ways. Close slide and table clearances are retained indefinitely with simple gib and way adjustments. Ways and slides are automatically pressure lubricated each semi-cycle.

TOOLS ARE PULLED . . . NOT PUSHED

Cylinder ram **PULLS** slide downward to broach work; ram is in **TENSION** under broaching load and not in compression. There's no ram **DEFLECTION** to cause wear on ram, packing and cylinder. Positive delivery of oil to pulling side plus a rigid column of oil on return side gives **SMOOTH** operation. Then too, you get up to 100% higher return speed and save power with our simple regenerative system.

These are only a few of the many exclusive features in Oilgear Fluid Power Variable Speed Broaching Machines. Write for complete descriptive bulletins. **THE OILGEAR COMPANY, 1563 W. Pierce St., Milwaukee 4, Wisconsin.**

Oilgear Fluid Power



Production Package ready to go . . .

Buy a Hendey 12" Universal Crank Shaper—plug it in—it's ready to go—without further purchases, because standard equipment *includes* table and vise for positioning and indexing work to any angle. You also get flanged mounted motor, mechanical controls on both sides, automatic lubrication, quick-change swivel head, adjustable, preloaded Timken bearings on the crank gear, plus many other features usually considered "extra".

The Hendey 12" Crank Shaper is finished like a fine watch, both inside and out. Here is an accurate, fast money-maker for tool room and production work. Write today for complete details.

BRIEF SPECIFICATIONS

Length of Stroke	12¾"
Strokes per minute	14 to 200
Speed changes	8
Vertical travel of tool slide	4⅝"
Table top tilts either way	15°
Max. distance vise to ram	8 13/16"
Max. rotation of table	360°
Max. vise opening	10½"
Net weight	2825 lbs.
Floor space	46" x 68"

Other Hendey Machines Include
Tool Room Lathes — 9"- 12"- 14"- 16"- 18"- 20"- 24"
Shapers — 12"- 16"- 20"

THE *hendey* MACHINE COMPANY

MAIN OFFICE & PLANT: TORRINGTON, CONN.

BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco

REPRESENTATIVES: Philadelphia, Cleveland, Pittsburgh

hendey

no other end mill will outperform a UNION

contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under the heading "Drills, Twist".

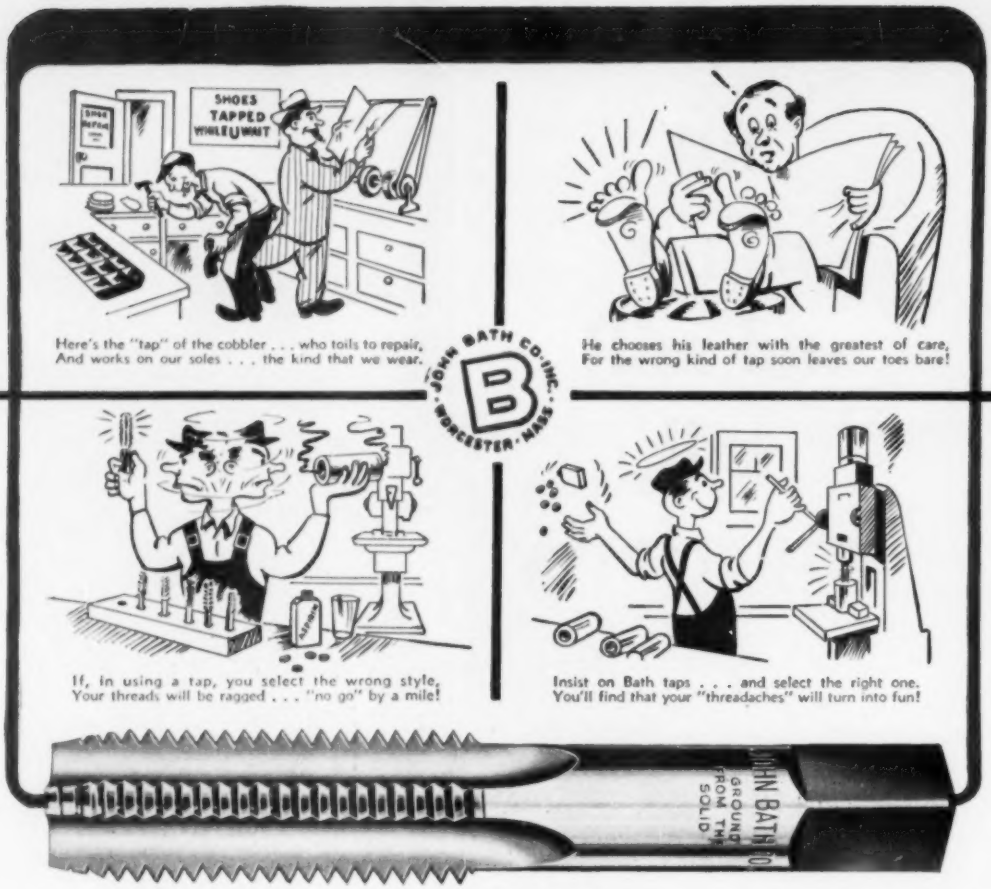
UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates.

BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers.

BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.


SHOES TAPPED WHILE U WAIT
Here's the "tap" of the cobbler . . . who toils to repair,
And works on our soles . . . the kind that we wear.
He chooses his leather with the greatest of care,
For the wrong kind of tap soon leaves our toes bare!
JOHN BATH CO. INC. WORCESTER, MASS.
If, in using a tap, you select the wrong style,
Your threads will be ragged . . . "no go" by a mile!
Insist on Bath taps . . . and select the right one.
You'll find that your "threadaches" will turn into fun!
JOHN BATH CO.
GROUND FROM THE SOLID

INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

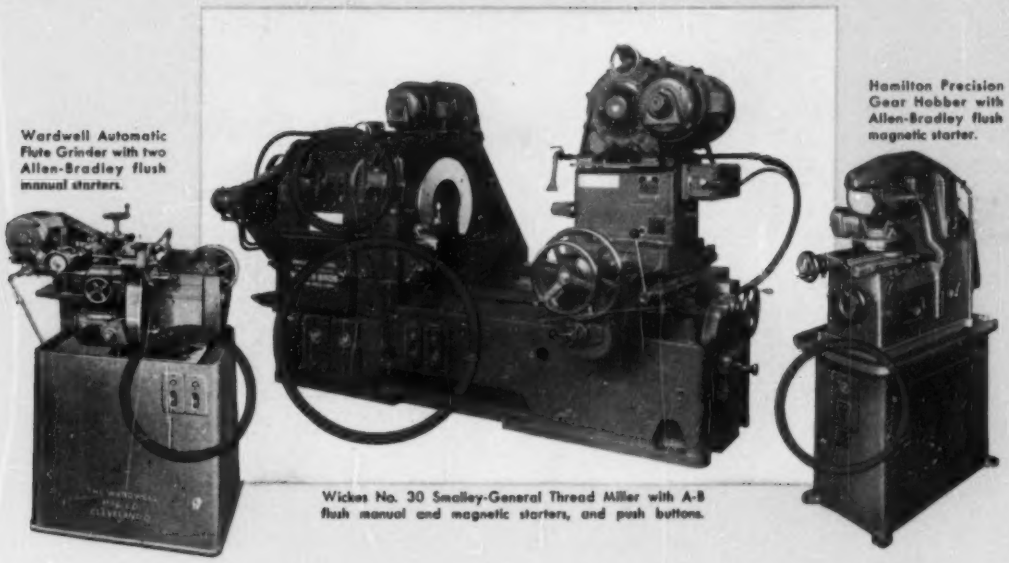
Bath taps are not just made . . . they have been especially designed to answer various requirements of threading different kinds of metals . . . are adapted to work under many different conditions of machine equipment. Available for ordinary work in stock sizes and styles . . . or, custom designed for jobs that present an unusual problem. Let experienced Bath engineers help you with your tapping troubles!

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED
22 Grafton St., Worcester, Mass.

Build In Your Motor Controls

and improve the appearance of your machines



Wardwell Automatic Flute Grinder with two Allen-Bradley flush manual starters.

Hamilton Precision Gear Hobber with Allen-Bradley flush magnetic starter.

Wickes No. 30 Smalley-General Thread Miller with A-B flush manual and magnetic starters, and push buttons.

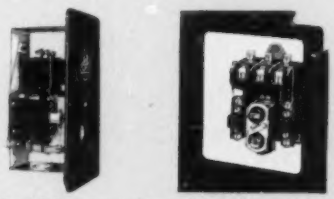
Modern styling calls for flush mounted starters that fit into machine bases. Above are a few examples of machine tools designed for "built-in" controls with flush covers.

Notice the smooth appearance of the machine bases. There are no control boxes to break the streamlined design . . . no exposed conduits to clutter the installation.

Allen-Bradley flush mounted starters are available for manual or automatic operation in various standard ratings and constructions. We shall be glad to send descriptive bulletins.

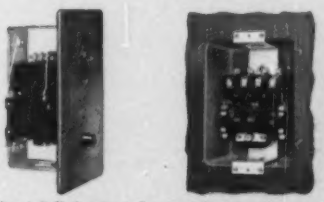
Allen-Bradley Company, 1316 S. Second St., Milwaukee 4, Wis.

BULLETIN 609 MANUAL STARTER



At left—A-B flush mounted manual starter in open type construction for enclosed recesses. At right—A-B manual starter in flush mounted cabinet for installation in open recesses.

BULLETIN 709 MAGNETIC STARTER



At left—A-B flush mounted automatic starter in open type construction for enclosed recesses. At right—Form 1 A-B unit installed in enclosed machine recess, with cover off.

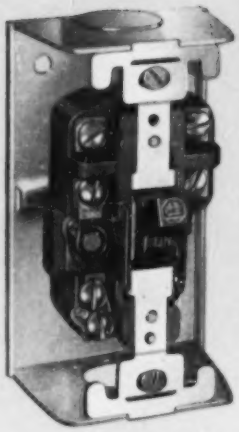
A-B Quality

ALLEN-BRADLEY

QUALITY

TROUBLE FREE MOTOR STARTERS

with RELIABLE OVERLOAD PROTECTION



For Fractional Horsepower Motors

The National Electrical Code requires overload protection for all fractional horsepower motors started automatically or by remote control. The Bulletin 600 switch satisfies this need. Its dependable, accurate, thermal breaker trips the switch under a sustained overload, and protects the motor against burnout.

QUICK MAKE AND BREAK CONTACTS—The simple, rugged, over center mechanism provides quick make and quick break contact action . . . therefore, long contact life.

GENEROUS WIRING SPACE—Though compact, this small switch provides plenty of wiring space. Its metal cover slips off, exposing front and two sides.

EASY TO INSTALL—No need to remove the starter from the enclosure during installation—saves at least 10 minutes of installation time.

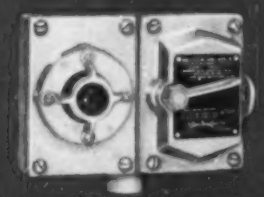
ATTRACTIVE APPEARANCE—This starting switch, with its clean, modern lines, is a sales asset to any motorized machine.

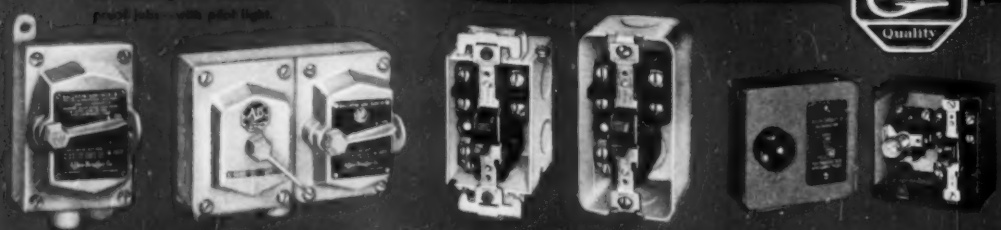
Allen-Bradley Company
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY

BULLETIN 600 STARTING SWITCHES FOR SMALL MOTORS

A-B Quality





And you'll never be able to forget, once you see how Cimcool takes over 85% of all metal cutting operations and does a better job. This revolutionary cutting fluid replaces all water emulsions and all but a few highly compounded specialty oils. It proves itself by improving machine performance.

Cimcool is different—a chemical emulsion—that combines friction reduction and cooling capacity in a degree never before attained. You get longer tool life, less down time. Cimcool lasts longer in the machines too, reduces the cost of cleaning and changing. And Cimcool permits faster speeds.

Proof? Let a demonstration in one of your own machines convince you. Write us and we'll have one of our Cincinnati Milling-trained machinists call on you. Or if you prefer, write for our free booklet "CIMCOOL Gives the Answers." Address, Sales Manager, CIMCOOL Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

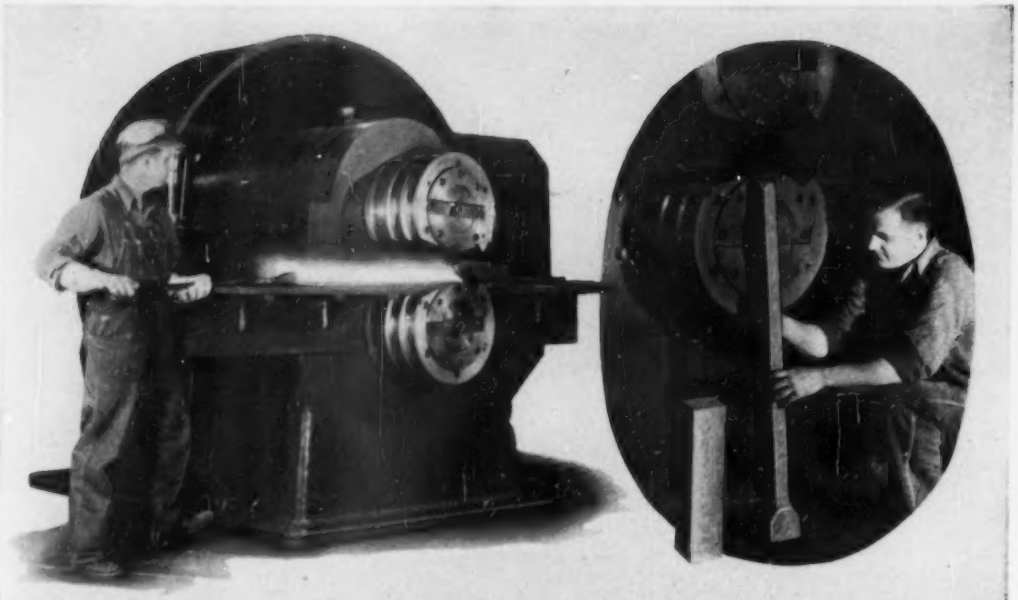
*Trade Mark Reg. U.S. Pat. Off.

A Production-Proved Product of THE CINCINNATI MILLING MACHINE CO.

CIMCOOL

for 85%

OF ALL METAL CUTTING JOBS



LARGE FORGING BLANKS PRE-FORMED ON REDUCEROLL

Five inch square stock can now be rolled into pre-formed forging blanks on National's No. 10 REDUCEROLL. This machine has the capacity for unusually large reductions, and with the aid of the foot treadle-clutch control, the operation requires no skill.

The job shown above at the right was rolled in three passes from stock measuring 4″ square x 18″ long to a 2″ x 3″ rectangular section and a length of 44″.

REDUCEROLLING gives you these advantages:

1. An unskilled operator can produce accurate, uniform pre-formed blanks.
2. The productivity and versatility of costly forging equipment is increased.
3. Flash is minimized, die life is thereby increased, and wear and tear on finish-forging equipment is reduced.

The REDUCEROLL can be classified as a "roving" tool as it requires no foundation and can readily be moved from one location to another. The roll dies are simple and inexpensive, and can be quickly changed from job to job.

Send us prints or samples of the parts you wish to forge, and let us help you investigate the application of REDUCEROLLING to them.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF
MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET, AND WIRE NAIL MACHINERY

New York Detroit Chicago

Stainless steel works miracles only when the *right* type is matched to the right application. Crucible, a pioneer in the development of stainless steels, offers the services of our unsurpassed metallurgical staff to help you make the right choice.

And Crucible produces a complete range of sheet and strip in gauges, grades and finishes from ½″ to 60″ inclusive, as well as all other forms: plates, bars, tubing, forgings, wire and castings to meet your specific requirements. Data sheets are available on request. CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, New York.

CRUCIBLE first name in special purpose steels

hot and cold rolled **STAINLESS SHEET AND STRIP**

STAINLESS • HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE • STEELS

MOVE MORE...SAVE MORE

Production is material in motion. That's why Yale Material Handling Machinery is so important to *your* business. Whether you use Yale Trucks, Hoists or Scales, the big advantages you get are faster handling of more material per day, greater production with less effort, better conditions of safety and the good will of employees relieved of heavy lifting and moving jobs. Result: far lower costs!

Regardless of what you receive, process, or ship, there's a Yale tool to keep it "on the move." Our nearby representative will gladly help you select the right lift truck, hoist or scale to give you the production efficiency and economy you want. See your telephone book or write direct to headquarters.

YALE
TOOLS THAT KEEP INDUSTRY "ON THE MOVE"

THE YALE & TOWNE MANUFACTURING CO.
DEPARTMENT L-87
ROOSEVELT BOULEVARD
PHILADELPHIA 15, PA.

High stacking provides wider aisles, makes storage facilities hold more, saves the expense of new buildings. Yale High Lift Fork, Ram and Platform Trucks assure such efficiency.

Fewer trips per day, less lugging and tugging—big capacity Yale Hand Lift Trucks nail down costs by freeing men's time for productive work.

Multi-unit loads lifted and moved by Yale Worksaver Pallet Truck save time and effort, eliminate much costly, hazardous rehandling.

"Safety First" for worker and load—that's what easy-to-use Yale Hand and Electric Hoists provide, aside from their fast, money-saving efficiency.

Accurate weighing means accurate shipping costs. Yale Load King Scales are made in types and capacities that "fit in" with material handling operations.

The difference between profit and loss often depends on accurate weight and count. Only Yale Load King Scales give you MAGNET-ROL weighing and counting accuracy.

YALE

MATERIAL HANDLING MACHINERY · *hoists . . . hand and electric · trucks . . . hand lift and power · industrial dial scales*

Card's system of *double* inspection — in the factory and independently, by the Pittsburgh Testing Laboratory — is your *double* assurance of satisfaction when you specify Card Taps... See your nearest Card Distributor for prompt, dependable service.

S.W. CARD

MANUFACTURING COMPANY
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL CO.

The CARD Quality

TAPS

The Certified Cutting Tools*

*by the Pittsburgh Testing Laboratory

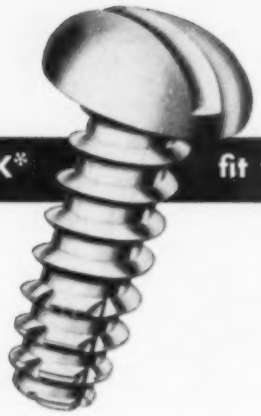
Also makers of DIES • SCREW PLATES
DIE STOCKS • TAP WRENCHES

How to save *most* in assembly

Eliminates Fracture, Stripped Threads, Tap Breakage. *Moldmaster Inc. chose P-K Type F-Z Screws to attach the Durez plastic panels to the sheet metal frame of this smart file cabinet. Extra fastening time, panel fracture and tap breakage would have made cost of this assembly prohibitive by any other method. Find out how you can make similar savings.*

Choose the "*short cut*" fastening method

When you make fastenings with Self-tapping Screws, you simply drive them in plain, untapped holes. You avoid tapping for machine screws, inserts in plastics and other assembly-slowing operations like nut-running and riveting. Stripped threads, tap breakage, and parts spoilage are no longer a problem, and your assembly is stronger. But choosing this common sense *method* is only the first step.



Let P-K* fit the fastener to the job

There are many types of Self-tapping Screws. Only Parker-Kalon makes *all* types. P-K fits the right fastener to your needs, not your needs to a fastener. Another reason why P-K can help you save most is their 35 year experience as Self-tapping Screw specialists. P-K applications number more than a million, many with savings up to 50% and over.

Find out what you can save. Call in a P-K Assembly Engineer, or send assembly details for recommendation. Complete details in booklet on request. Parker-Kalon Corporation, 200 Varick Street, New York 14, N. Y.

*Trade Marks Reg. U. S. Pat. Off.

The Original

P-K TRADE MARK **PARKER-KALON* SELF-TAPPING SCREWS**

A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

HOW PARKER-KALON HELPS YOU PLAN FASTENING ECONOMY

A P-K ASSEMBLY ENGINEER will study your fastening problems, make P-K laboratory tests when required, prepare a complete report on possible savings. No obligation.

P-K SELF-TAPPING SCREW "USERS' GUIDE" describes all types. Includes handy selector chart—recommended hole sizes—stock sizes—other engineering data. Free on request.

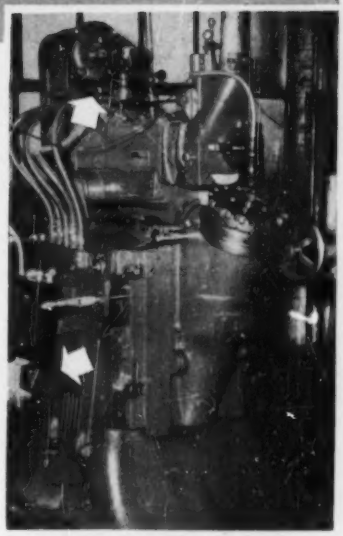
Check either or both, tear off on dotted line, attach to your letterhead and mail to PARKER-KALON, 200 Varick Street, New York 14.

Century MOTORS'

REMARKABLE FREEDOM From VIBRATION

HELPS YOU MAINTAIN TOOL ROOM

Precision ON PRODUCTION JOBS



Two Century 1 Horsepower squirrel cage motors driving milling machines in a well-organized shop.

Century MOTORS' ability to start and run smoothly and quietly minimizes the possibility of transmitting vibration to parts being machined. Their remarkable freedom from vibration permits closer tolerances, higher production rates, fewer rejects, lower production costs.

Century motors are built to match the precision of the machines they drive. They are correctly designed, accurately constructed, well-balanced mechanically and electrically, and thoroughly tested.

When you select the right Century motor, you can be sure that it's pre-engineered to meet the requirements of your machine.

It's easy to select the right Century motor for your job because Century motors are built in a wide range of types — in sizes from 1/6 to 400 horsepower — to meet all popular electric power requirements.

Specify Century on all your new equipment — and for replacement. Write for new bulletin on selective speed drives which permit electrically selected optimum speeds.

Popular types of standard ratings are generally available from factory and branch office stocks.

ALTERNATING CURRENT MOTORS

POLYPHASE
- Squirrel Cage Induction — 1/6 to 400 HP
- Wound Rotor Motors — 1 to 350 HP
- Synchronous — 20 to 150 HP
- Split Phase Induction — 1/6, 1/4, 1/3 HP
- Capacitor — 1/6 to 20 HP
- Repulsion Start Induction Brush Lifting — 1/2 to 15 HP

DIRECT CURRENT MOTORS
1/6 to 300 HP

GENERATORS
- AC 500 Watts to 300 KVA
- DC 250 Watts to 200 KW

MOTOR GENERATOR SETS
- AC to DC, AC to AC
- DC to DC, DC to AC

OPEN PROTECTED, SPLASH PROOF,
TOTALLY ENCLOSED FAN COOLED, EXPLOSION PROOF

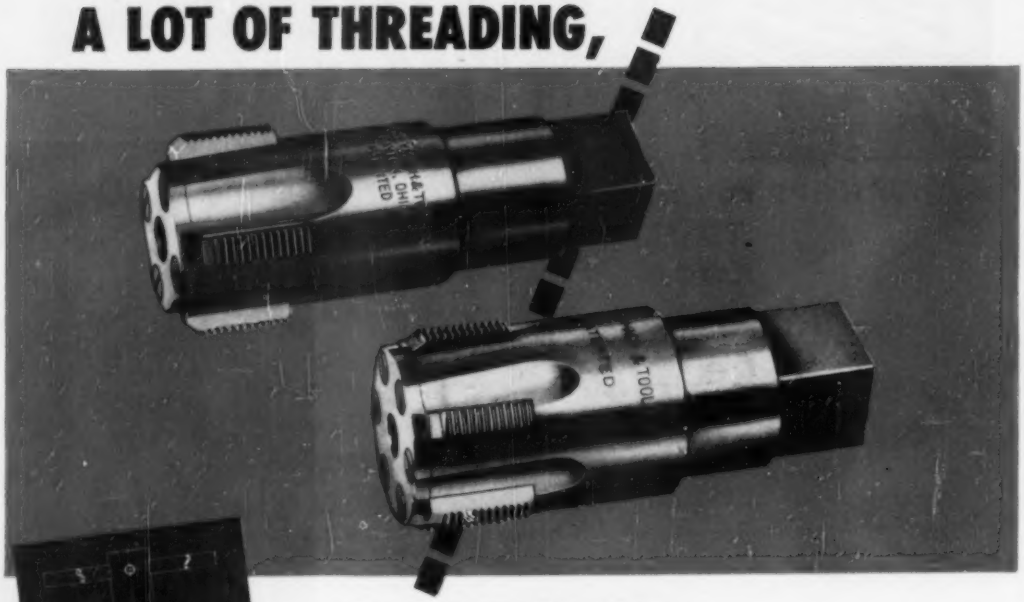
Ball Bearing Motors are factory lubricated for several years' normal service. Bearing housing construction permits easy re-lubrication when unusual service demands it.

CENTURY ELECTRIC COMPANY Century MOTORS **1806 Pine St. • St. Louis 3, Mo.**

Offices and Stock Points in Principal Cities

649

IF YOU HAVE A LOT OF THREADING,



Taps "EHB" and "RHB" (4 and 6 chasers) models are standard in sizes from 1¼" to 6". Special taps of this kind can be made entirely to your specifications. Bottoming taps are available by use of overhanging chasers.

these MURCHEY taps will *Save you money*

Contrast these Murchy Adjustable Taps with the conventional, solid tap on a straight unit cost basis (cost per inch of threaded hole). Every tap, after a certain amount of use, has to be re-ground. You can regrind the chasers of these taps and still retain exact size because of their adjustable feature. In fact, you can keep on regrinding the chasers both on the chamfer and the face and adjusting them radially outward until there are practically no cutting teeth left. And then, merely with a new set of chasers, you can start the whole cycle over again. A set of chasers costs a lot less than a new, solid tap.

Another saving is that a single tap body may be used for a wide range of sizes and pitches with the appropriate chasers.

5072

Write for catalog

MURCHEY MACHINE & TOOL CO.

Since 1904

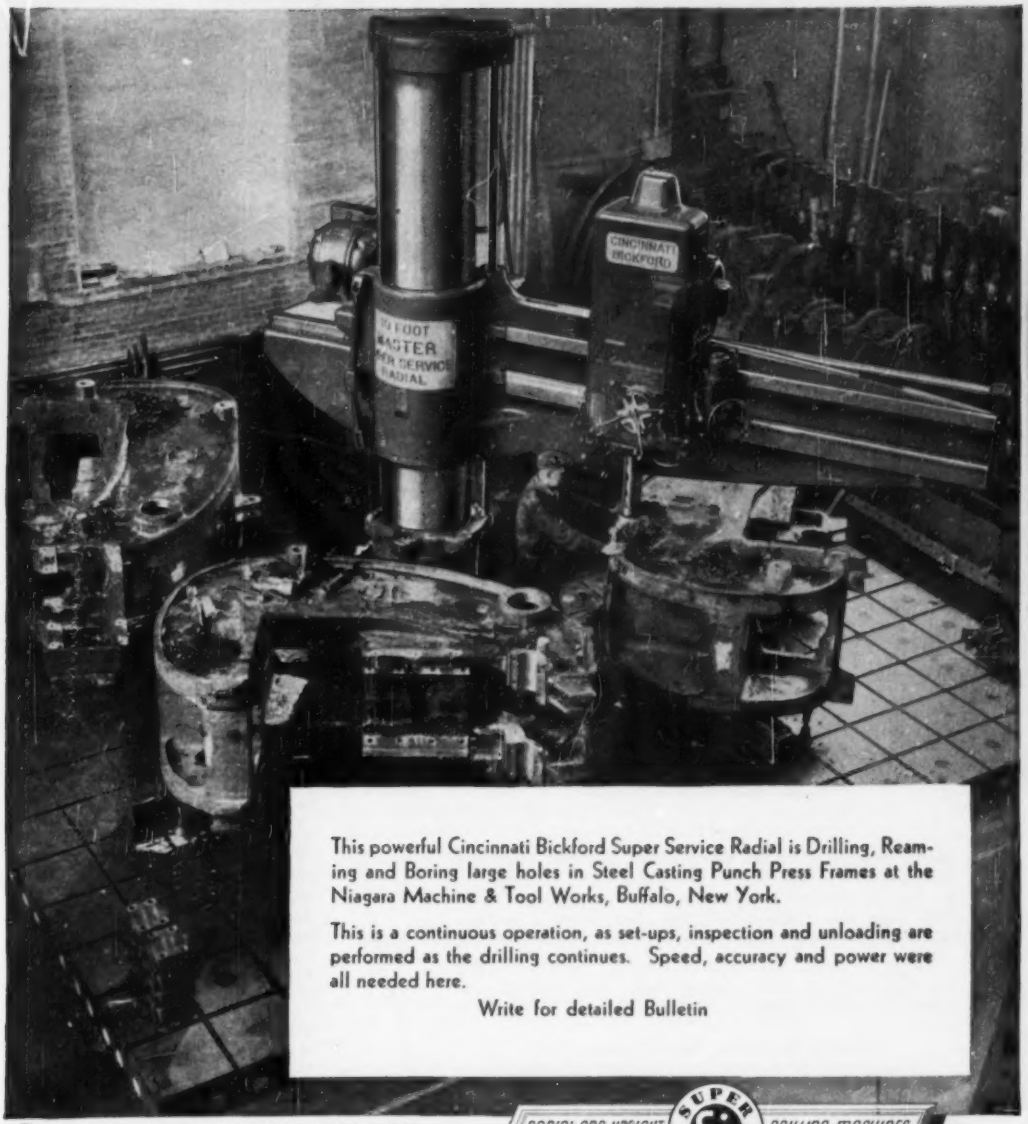
Lower cost per thread . . .
WITH MURCHEY TOOLS

MURCHEY

DAYTON 1, OHIO, U. S. A.
SUBSIDIARY OF THE SHEFFIELD CORP.

Manufacturers of collapsible taps, self-opening die heads (tangent and radial chaser types) and special threading tools

THE machine TO DO IT...



This powerful Cincinnati Bickford Super Service Radial is Drilling, Reaming and Boring large holes in Steel Casting Punch Press Frames at the Niagara Machine & Tool Works, Buffalo, New York.

This is a continuous operation, as set-ups, inspection and unloading are performed as the drilling continues. Speed, accuracy and power were all needed here.

Write for detailed Bulletin

Courtesy of Niagara Machine & Tool Works, Buffalo, N. Y.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

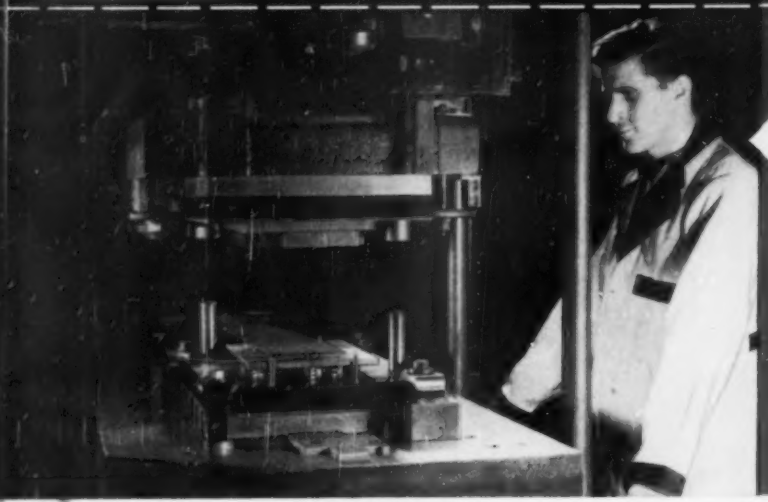
Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

less time

IN THE DIE SHOP

Reliable Danly precision makes die assembly quicker and easier . . . possible reworking of die sets to make them square and true is eliminated. Precision leader pin and bushing fits assure accurate die closure and protect delicate die components. Danly Die Sets mean better dies in less time!



longer life

ON THE PRODUCTION LINE

Hardened, ground and lapped leader pins resist wear . . . accurate die relationship minimizes punch shearing and die breakage. Precision Danly Die Sets justify die maker's precision in the press setup, preventing premature die wear. Danly Die Sets mean more parts per grind!

Courtesy Quality Hardware, Chicago

Danly precision makes every Danly Die Set a reliable foundation for the finest die work. And in addition to the performance advantages they assure, Danly Die Sets are quickly available, too, from a nation-wide system of completely stocked assembly branches.

Large or small, standard or special, there's a Danly Die Set to meet every tooling need. Just contact your nearest Danly branch for fastest delivery of the best in die sets.

Danly Machine Specialties, Inc.
2100 South 52nd Avenue, Chicago 50, Illinois.

WRITE FOR THIS FREE BULLETIN

. . . and see how Danly's special die set machining service can help reduce your costs.

WHICH DANLY BRANCH IS CLOSEST TO YOU?

*Chicago 50, 2100 South 52nd Avenue
*Cleveland 14, 1550 East 33rd Street
*Dayton 2, 990 East Monument Avenue
*Detroit 16, 1549 Temple Avenue
*Grand Rapids, 113 Michigan Street, N.W.
*Long Island City 1, 47-28 37th Street
*Los Angeles 54, Ducommun Metals & Supply Co., 4890 South Alameda
Milwaukee 2, 111 East Wisconsin Avenue
Philadelphia 44, 18 West Chelten Avenue
*Rochester 4, 16 Commercial Street

*Indicates complete stock

DANLY

DANLY PRECISION DIE SETS . . . STANDARD AND SPECIAL

OVER 25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

SPOT NEWS OF METALWORKING

New larger jet engine for Air Force, to be built by General Electric, will require only about $500,000 in new tooling. Equipment will be bought by subcontractors who will make parts and subassemblies. General Electric will do the assembly and testing work. It has the prime contract. Engine is new version of GE's present jet design.

For possible future use as the site of an eastern seaboard steel mill, Carnegie-Illinois Steel Corp. has acquired a 3800-acre tract of land on the Delaware River in Falls Township, Pa. about 30 miles northeast of Philadelphia.

More than $400 million worth of machinery and equipment was bought by Marshall Plan countries in United States with ECA money last year. France was the biggest buyer, placing more than a quarter of the orders.

Removal of metal particles from the abrasive after sand-blasting with machines which use sand over and over again has been simplified by suspension of a magnet in the sand storage hopper. Metal particles returned with the sand and mixed in the abrasive do great damage to the sand-blaster as well as to the material being worked.

Rugged, light-weight infrared weld-zone preheaters, which save considerable time and also assure crackproof welds, have been developed. The new method, which employs a wound resistor element as a radiation source, takes one-twentieth the time of the older strip heaters. Leech magnets are used for attachment to any shape of surface.

A crystal rectifier the size of a match head, a field switchboard weighing only 22 lb, and a portable teleprinter weighing 45 lb, are among the items developed by Army Signal Corps in an intensive program of miniaturization. Miniature and subminiature radio tubes have also been produced. The program is aimed at developing equipment which can be handled with greater facility by fewer personnel, and which is capable of withstanding extremes of climate.

Left-wing United Electrical Workers will make plenty of trouble for its right-wing opposition if some recent elections are indicative of what's to come. The UE's farm equipment council fought off Walter Reuther's UAW-CIO at International Harvester's Lousiville plant by a 2-to-1 margin. At Sunbeam Corp., in Chicago, the UE easily defeated an attempt by the AFL elctricians union to take over bargaining rights.

For security purposes, Stewart-Warner Corp. will not employ Communist sympathizers at its Chicago main plant. Suspects must sign non-Communist affidavits or lose their job.

Lockheed Aircraft plans a $500,000 building to house its new Cecostamp and Hufford stretch press. Besides the presses, a large degreaser, heat-treat oven, 8000-ton Hydropress, foundry pots and a large boring mill will be installed.

Bill Jack, of Jack & Heintz fame, is developing a number of aviation products (including valves, cylinders, flow gages, electric motors, accelerometers) at his Scientific Instrument Co. at Solano Beach, Calif. He is said to be working closely with 19 small Cleveland companies each of which is run by individuals or groups who formerly worked at Jack & Heintz during the war. He is reported on the verge of getting two government contracts.

Nash is showing in New York a prototype of a car designed along Continental lines to be sold at around $1,000. It intends to poll the public on whether it would buy such a car, which might be powered by a European-designed engine (see "Detroit," page 138).

Gaging Metalworking

The metalworking industries are going into 1950 with plenty of work in most segments to keep busy at well over twice the prewar rate during the winter months. Consumer-goods manufacturers are operating relatively better than durable-goods producers, though the latter are doing well, too.

There has been a resurgence of demand lately for many metalworking items. Backlogs in some lines are considerably greater today than they were a year ago. That is true in automobiles and in refrigerators, for example.

Inventories Below Normal

The fact is that the automobile and household appliance industries will be major factors in sustaining metalworking production on a high plateau during January and February. Stocks in dealers' hands are below normal. And incoming orders are sufficient to prevent inventories from being built up even to moderate proportions for some weeks ahead. Westinghouse reports, for example, that its appliance output will be increased about 15% in the first quarter to help correct a tight situation which grew out of a sharp pick-up in demand and the shortage of steel resulting from the eight weeks' strike.

Television sets should be turned out this year in a volume far surpassing the 1949 total. Production should reach 3½ million units, as against 2 million last year.

Machine Tool Sales Up Sharply

The upturn has not been confined to consumer goods, however. In November the machine tool industry staged a sensational comeback in new orders, which jumped on the National Machine Tool Builders Association index to 84.3 from 56.8 in October.

That is the highest point attained since last March (93.5) and almost matches the best month in 1948. It is in striking contrast with the low spot (48) of last July.

It is believed that December's orders were just as good as those in November and perhaps slightly better. These gains at the tag end of the year originated mostly in domestic orders. Considerable part of the improvement came from new tooling programs in the automotive industries. January also should produce a generous share of orders from domestic sources, with Detroit contributing heavily to the total.

Ford, for one, has two if not three new engines in the preliminary stages, presumably for 1951 models to be introduced late in 1950.

Foreign Business Off

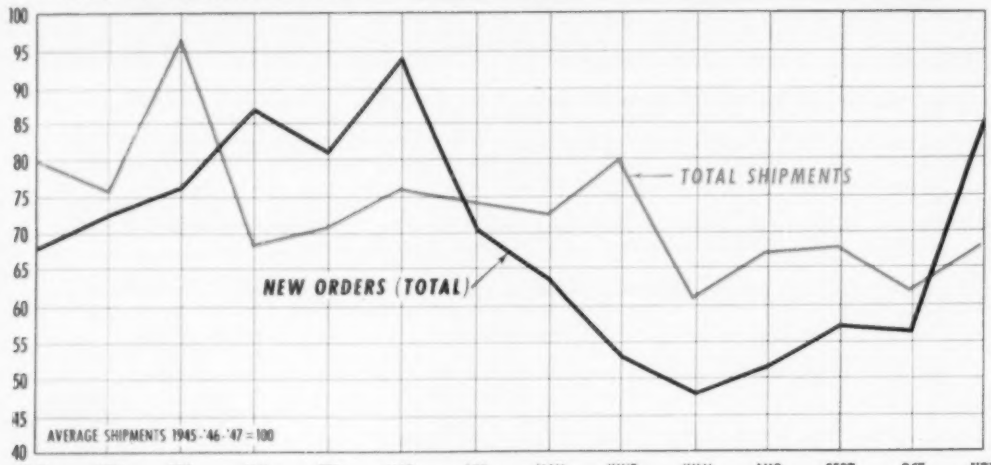
The proportion of foreign business to over-all machine tool bookings dropped in November to 20%. At times the last year the ratio of export to the total got up as high as 35% and ran consistently at 25% or more throughout most of the year.

Shipments rose mildly during November to 68 on the NMTBA index, compared with 62.3 in October. It is estimated that December will show a further rise, as builders usually do their best to complete as many machines as possible at the year-end.

Malleable Iron Orders Steady

Operations in the malleable iron industry are roughly 65-70% of capacity. That is up somewhat from last summer's low. The current vol-

NEW MACHINE TOOL ORDERS SHOOT UP NEAR YEAR'S PEAK

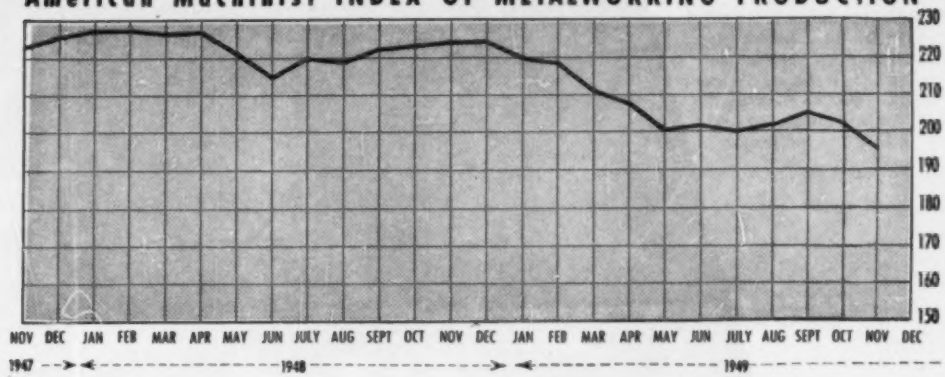


	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
New Orders (Total)				87.0	80.9	93.5	70.1	63.7	53.6	48.0	51.5	57.7	56.8	p84.3
Foreign Orders (Incl. in Total)				21.9	26.5	22.3	23.1	15.9	15.7	14.0	18.8	13.7	13.7	p17.1
Shipments (Total)				68.8	70.3	75.8	74.9	72.8	79.0	60.7	67.3	67.6	62.3	p68.0

Data: NMTBA

p—preliminary figures

American Machinist INDEX OF METALWORKING PRODUCTION



INDEX	COMPONENTS				
	MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANSPORTATION EQUIP.	OTHER METAL-WORKING
Nov. 1949 (preliminary) 196	193	197	238	279	130
Oct. 1949 202	194	194	240	288	135
Nov. 1949 224	250	236	223	311	159

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 13.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1. Index figures are a percentage of 1939, which equals 100.

ume is not likely to rise further until the railroad industry becomes more active in buying equipment.

Orders are coming in at a steady pace. The industry thinks that inventories have been worked down to normal or under and the future market will be sound. The boost in steel prices will have little or no effect on the malleable business.

Sales by the gearing industry declined 4.8% in November from the October figure. The index of the American Gear Manufacturers Association stood at 230.7 for November, with 1935-1939 equal to 100.

Output of Electrical Goods High

Production of heavy electrical equipment will go on at practically full capacity throughout 1950, because of the big backlogs. However, the size of the backlogs is being whittled down considerably and manufacturers are beginning to worry about the lack of new buying on the part of public utilities.

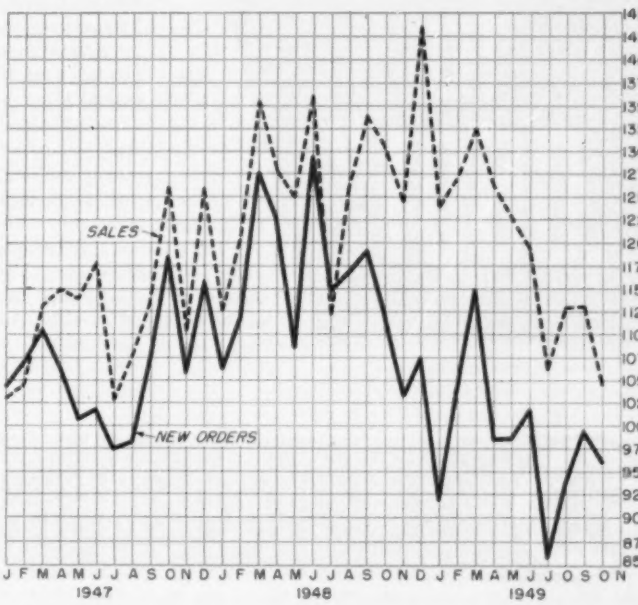
Makers of electric motors feel good about the outlook for the first quarter. A pick-up has taken place in demand for motors of all sizes. Fractional horsepower motor output still is on a six-day basis at some factories.

The upward revision of extra charges on steel will result in a careful search by users to see how they can offset the higher costs. The rise in steel prices, first announced by U.S. Steel, has become general. Demand for steel continues strong, especially for sheet and strip. The ability to get finished steel will be the deciding factor in production of many metalworking products the next 60 days. But all users should be able to get whatever tonnage they need by April.

How Non-Electrical Machinery New Orders and Sales Compare

(See story page 137, column 1)

(In Millions of Dollars)



Falk gear shown being cut is 15 feet in diameter, has a 42-inch gear face. Coolant used on hobs is *Texaco Sultex Cutting Oil*. No machining job is too big . . . or too small . . . for Texaco.

ACCURACY to .0001"

Falk keeps hobs sharp with TEXACO SULTEX CUTTING OIL

Picture shows first cut — about a 5-day job — on a giant Falk double helical reduction gear. On finish cut — a non-stop, 72-hour operation — *the two hobs must not change dimensions 1/10,000 of an inch!* If they do, the big gear will have to be recut. Hobs *must* stay sharp.

Texaco Sultex Cutting Oil is used here . . . and on hundreds of other difficult machining jobs . . . because of the effective way it lubricates the hob . . . keeps tool and work cool . . . prevents chip welding . . . assures better surface finish.

Texaco Sultex Cutting Oil is but one of a complete line of Texaco cutting, grinding and soluble oils . . . designed to assure longer tool life and better, faster machining whatever the metal or the method of cutting it.

Let a Texaco Lubrication Engineer, specializing in cutting coolants, help you improve machining efficiency and reduce costs. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

TUNE IN . . . TEXACO presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

What Materials-Handling Costs

Have you taken a careful look lately at what it costs to move parts and materials around your factory?

If you haven't, you may get a shock when you do. You may even feel the urge to do what a prominent midwestern metalworking manufacturer has just done.

He made a detailed study of the main cost factors in fabricating his products and came up with an important discovery.

He found that his biggest expense item was in picking up and putting down work. This expense consisted of getting the work into and out of the machines, and in moving it from one machine to another.

This "burden" made up some 35 percent of his total direct labor charge. If he could cut it substantially, he could make a great saving.

He decided to combine into one new factory the work formerly done in three scattered plants. He laid down only one rule for his planners to follow: the new factory should be on one floor and should have the easiest possible flow of materials and parts. Wherever practical, mechanical-handling units should assume the tasks heretofore done by human muscles.

The results achieved were exactly as predicted. The productivity per manhour in the new plant has been stepped up tremendously. The manufacturer's largest single production expense has been cut in half. Though his labor's hourly rates are higher than ever, he has been able to bring down his over-all costs.

This story came to us directly from the lips of the manufacturer who had the experience. Whereupon we began inquiring among metalworking companies about the cost of handling work in process.

What surprised us was the lack of exact knowledge on the subject by manufacturers who have hundreds of thousands of dollars, and in many cases millions, at stake. Their replies were mostly vague.

They never had taken the trouble to examine closely how much it cost to move a piece from one place to another. They had time studies on machine operations and on some other processes. But not on materials-handling.

They indicated, though, that they thought that it was costing them too much to handle their work. It was just a hunch or a conclusion based on casual observation. They intended to do something about it.

If you were asked the same question as these manufacturers, what would be your answer?

In case you have neglected your materials-handling costs, our suggestion is that you get busy right away and put the spotlight on them. For the fact is that costs have been analyzed and appraised more carefully in almost every other sector of manufacturing than in materials-handling.

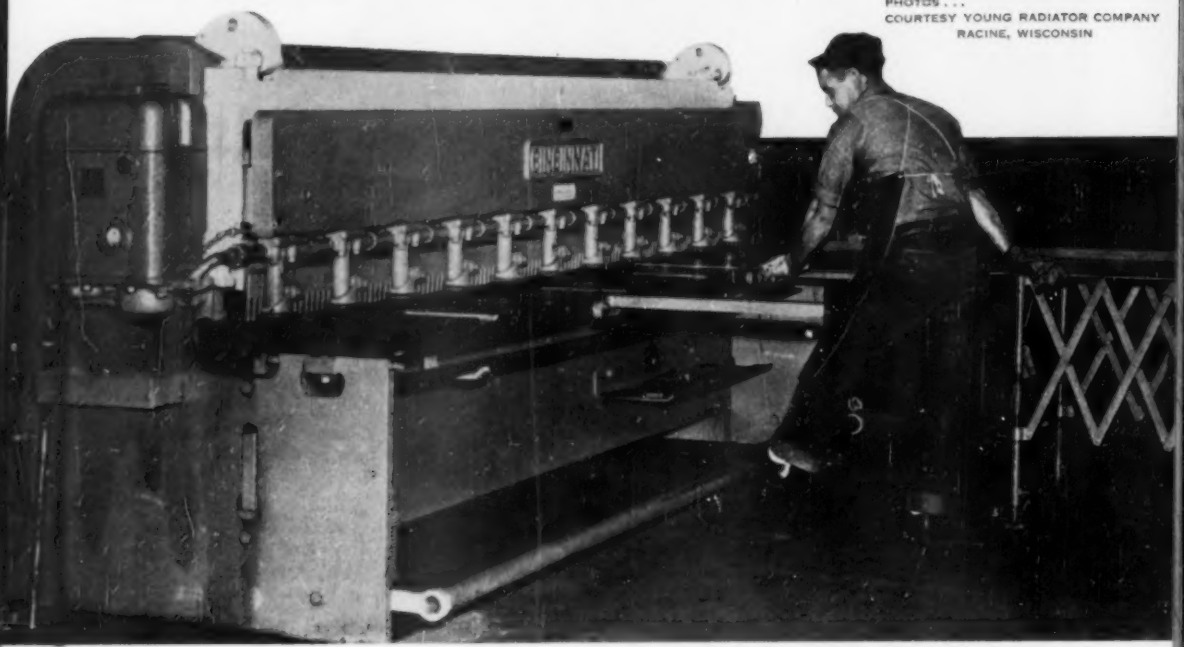
You are likely to discover, as the midwestern manufacturer did, that analysis and appraisal of your materials-handling costs, if followed by appropriate action, will be unusually rewarding.

Burnham Finney

EDITOR

ALL SHEARING BY CINCINNATI . . .

PHOTOS . . .
COURTESY YOUNG RADIATOR COMPANY
RACINE, WISCONSIN

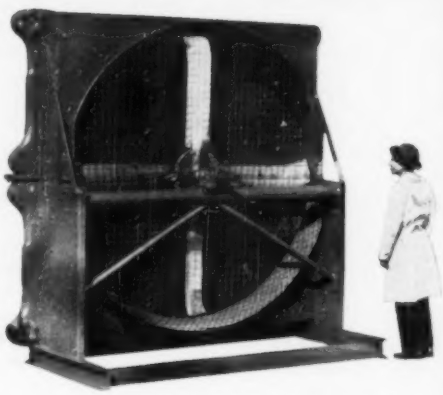


All the steel parts requiring shearing operations on these engine jacket water coolers are handled by Cincinnati Shears.

The rapid stroking and gauging of Cincinnati Shears save time, and the square corners and straight edges of blanks produced on Cincinnati Shears cut assembly costs and speed production.

For best results, consult our Engineering Department. We will gladly cooperate with you on your shearing needs.

Write for Catalog S-5 for a description of the complete line of powerful, speedy, all-steel Cincinnati Shears.



The Young-Happy Full Flow Engine Jacket Water Cooler with 93" variable pitch fan.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Utmost cleanliness is required for equipment and handling of gage blocks in the lapping department so work in process will not be scratched

HOW GAGE BLOCKS ARE MADE

Technique in manufacturing gage blocks has as its object the production of maximum planeness of a surface, but the methods employed should help others who require a relatively flat surface

BY RAY GIERLICH,
Master Gage Maker, DoAll Gage Div. THE DOALL COMPANY

PRODUCTION of a plane surface that constitutes a high percentage of the total surface of an object is not the result of hocus-pocus. Rather, the achievement is solidly based on painstaking care, close control of all processes, and patience.

If you ask a man how gage blocks are made, he will probably answer: "Lap three together," and be unable to give the details. The secrecy that has surrounded the process presumably springs from the fact the procedures were developed in the laboratory. But, of course, the making of gage blocks is now a manufacturing proposition. Transformation of quantities of small rectangular blocks of steel into gage blocks dimensionally accurate to millionths of an inch and surface roughness within 0.6 rms within is based upon refinements of known machine-shop operations.

As in any other product, the basic requirements dictate the methods for manufacturing gage blocks. Seven matters require close attention: thermal expansion, hardness, stability, size, flatness, parallelism and surface finish.

Recent advances in gage-block manufacture have to do with surface finish. It was not until 1942 that the U.S. Bureau of Standards added a surface-finish requirement to the Standards criteria for gage blocks. At the time, the Bureau, in recognizing the importance of surface finish as related to gage-block wear and wringability, established a standard of 2.6 micro-inches rms as being an acceptable gage surface and one which could be produced by the gage-block industry.

As the gage industry showed that it could produce more perfect surfaces, the Bureau of Standards raised the standard, until today the recommended criteria of surface finish for 'A' grade blocks is 0.6 micro-inch rms profilometer reading.

With a well-finished gage block, even the fine hairlike scratch produced by a surface-analyzer stylus becomes prominent

Surface-analyzer tips are too large to follow the roughness pattern of the minute imperfections on a gage-block surface

The importance of surface finish to gage blocks lies in their method of use. Gage blocks are generally wrung together in combinations to give the exact dimension required. This wringing operation brings the two lapped gaging surfaces in contact and induces wear of one or both. Such wear is slight, to be sure, but when it is considered that gage blocks are accurate to within a few millionths of an inch, a wear of a few millionths greatly impairs their accuracy. A combination of ten wrung blocks, with each gaging surface worn five millionths, results in a combined dimension that is 0.0001 in. undersize.

Wear on gage-block surfaces takes place in four ways: The first type consists of a bending over the peak irregularities. On some gage blocks, these fine hairlike projections are less than 0.0001 in. in width and are readily bent over, thus reducing the size of the gage. The second form of wear is actual breaking off of the hairlike projections. The third is attrition of foreign particles or of broken-off particles, which cut new scratches, thus gradually wearing away the gage surface. The fourth is caused by contact with sharp tools or instruments such as the sapphire or diamond point of a comparator which cuts scratches as well as bends over peak irregularities.

From the foregoing it can be seen that the absence of scratches immeasurably improves the gage block's chances of longevity. A perfect gage surface is one having no hairlike projections to bend over or break off; having 100% of its surface at the measuring plane and having no scratches to trap foreign abrasive particles.

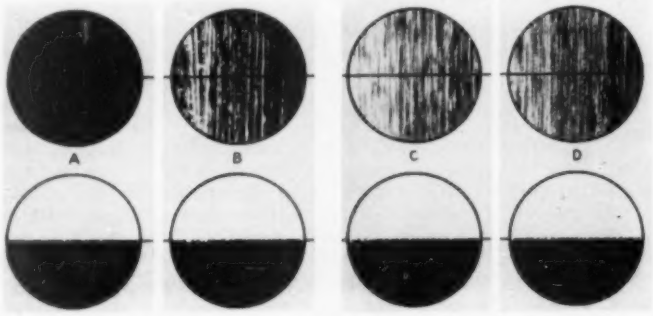
The purchaser of gage blocks, in most cases, cannot check the surface finish of the set of blocks he buys and usually relies on the appearance of the gage surfaces as the criterion of quality. This is an inaccurate test. Appearance of finish can be very misleading. A bright, shiny finish does not necessarily mean a good finish. A scored and scratched surface, having many facets, will reflect light in all directions and give the impression that the surface has a highly polished smooth finish. A gage block having nearly a scratch-free surface may appear quite dull unless all the reflected light reaches the eye.

Imperfections on gage blocks are caused in lapping by abrasive particles that are generally spherical and are either rolling or fixed while performing their work. The rolling abrasive particle produces a scratch no deeper than its diameter which will also be the scratch width. Nearly all scratches are caused by a rolling abrasive, and these are identified by their "hen track" appearance or, if continuous, by irregular roughness at the valley of the scratch. Abrasive imbedded in the cast-iron lap cuts uninterrupted grooves.

To develop data on the effects of surface finish on gage-block wear, photomicrographs of actual cross-section were made. This method was not suitable because the surface imperfections are so minute. Hence, photographs were made with dark-field illumination and compared with cross-sectioned Faxfilm replicas of the surfaces studied. In the worst example, the measuring plane of the surface constituted only 49.8% of the total, the balance being scratched and pitted. The best example had no peak irregularities, 96% of the plane of measurement was exposed, and in terms of wear life that block was capable of retaining its original accuracy many times longer than the others.

Manufacture of Gage Blocks

American standard gage blocks are produced from bar stock of



Comparison of surfaces of standard A grade gage blocks: Upper row of pictures: photomicrographs of surfaces made by dark-field illumination. Peak-to-valley irregularities show as white lines. Lower row of pictures—Sectioned Faxfilm impressions. Evaluation of these photographs shows:

	A	B	C	D
% Measuring plane to total surface	96%	60%	54%	49.8%
Average depth of scratch	*	—	0.00012	0.00017
Average width of scratch	*	—	0.00012	0.00015
Wear life	Max.	Good	Poor	Poor

*Scratches are a line of pits, not continuous

During lapping, gage blocks are interchanged in the work-holders to maintain flatness and parallelism

Finish grinding of 0.700-in gage blocks allows 0.00035 in. on each face of the blocks for lapping

SAE 52100 or similar analysis. These steels, having a small chrome content, combine the optimum qualities of hardenability, stability after treatment, wear resistance, resistance to corrosion and proper thermal expansion. The material is easily machined in the annealed state and grinds nicely after hardening.

The blocks are first cut to length (the length of a gage block is in every case the distance between the measuring faces) allowing 1/16 in. for finishing. They are then ground all over to remove decarburization.

Rough-ground blocks are batch hardened in a gas-fired muffle furnace, and quenched from 1550 F into oil. After tempering, each block is hardness tested and must test 65 Rockwell C scale or better.

Blocks are ground in lots of 200 on a 6 x 18-in. DoAll precision surface grinder. Regrinding all sides to finish size is the first operation. This brings the gage face to a 0.350 x 1.375 in. finish dimension. The faces are then reground allowing 0.00035 in. on each face for lapping.

At this point, the first deviation from ordinary gage-making procedure takes place. This is the stabilizing process, which assures that the size of the gage block will remain the same over a period of years. The blocks are alternately cooled to -115 to -120 F for a period of hours, then warmed to 200 F, cooled in air, subjected to the deep-freeze treatment, etc. The cycle is repeated 20 times to be certain that austenite is completely transformed to martensite.

To check the stability of gage blocks, the National Bureau of Standards has developed a test which consists of boiling a block for 24 hr in a ½ to 1% solution of potassium dichromate and water. Should the block change dimensions by more than two millionths per inch, it is not considered stable.

Blocks, after stabilization, are stacked in racks at room temperature for several months before finishing.

Before lapping, each block is inspected for cracks caused by hardening or grinding, for internal flaws, and for any variation in hardness. For this purpose, a GE magnetic comparator is used, whereby the electrical resistance of each block is compared with a known standard.

Lapping Procedure

The lapping and finishing rooms are dusttight and are supplied with filtered air to maintain temperature at 68 F and relative humidity at 45% maximum. Lapping is carried out in modified Norton Model 10U lapping machines. These have a floating upper and rotating lower lapping plate, each cored at the center. Through the cored hole of the rotating lower plate extends an eccentric bearing against the work-holding spiders. Eccentric action is such that motion of the spiders will not repeat in 220,000 revolutions. Lapping plates are of fine-grain Meehanite iron, time tested for stability and for freedom of slag inclusions. All lapping plates are kept in sets of three and are worked together in sets of three to insure flatness.

Rough Lapping—Removal of the first 0.0006 in. from the gage surfaces is called "rough lapping." The lapping plates are first themselves lapped together with abrasive to charge the lap faces and to flatten the laps to less than one-half wave length of light or maximum error of ten millionths per inch. Testing for flatness of laps is made by means of an optical flat. Abrasive used for charging the laps is 300-grit silicon-carbide.

Blocks are arranged in work-holders or spiders. These consist of hardened steel plates punched with rectangular holes just large enough easily to receive the gage blocks.

Rough lapping is carried out until the blocks are 50 millionths of an inch over size. During lapping, the blocks are interchanged at regular intervals so uniform wear takes place on each block. The system of interchanging is extremely important. Accompanying illustrations show the sequence of changes for a lot of 28 blocks. Lapping time between changes of block positions will vary, depending on the rate at which the laps cut. In rough lapping, interchanging is done each time the block is reduced 0.000025 in.

Measuring the length of gage blocks during rough lapping is carried out on an electronic comparator having 0.000010-in. graduations. No special precautions are taken in respect to thermal expansion in rough lapping, except that all blocks are brought into the gage room 24 hr before lapping so that they will be at room temperature of 68 F.

The second lapping operation is similar to rough lapping, with the following exceptions:

The lapping plates (not the ones used in rough lapping) are worked together to a flatness accuracy of ¼ wavelength of light or 0.000005 in. in 4 in. A 900-screen size abrasive is used to charge the laps. Interchanging is the same as in rough lapping, except that it is performed each time the blocks are reduced in size by 0.000010 in. The blocks must be placed in kerosene at 68 F before each measurement to compensate for heat generated in lapping.

Measurements of flatness are made with optical flats each time the blocks are interchanged. If blocks are not all of uniform size within 0.000005 in., or if not flat, the interchanging is stepped up to each time the block is reduced in size by 0.000005 in. Flatness, uniformity of size and parallelism must be watched carefully. If one of these requirements is not correct, it is a result of improper interchanging, but, if not, the flatness of the laps is checked as a probable cause.

Further reduction in size from +0.000020 in. to +0.000010 in. is done with levigated aluminum oxide of ten-micron particle size. The laps are charged as explained in rough lapping and are worked to a flatness of 0.000003 in. Interchanging is performed as often as every 3 sec or after each ¾ rev of the eccentric.

The blocks are handled with gloves or forceps to prevent absorption of body heat each time they are handled. All blocks are measured between interchanges, after immersion in 68 F kerosene for 30 min per inch of length or fraction thereof.

After the blocks are reduced to 0.000010 in. oversize, further lapping is done using uncharged laps. The lapping plates are first flattened to a tolerance of 0.000002 in. in 4 in. by means of ten-micron levigated alumina abrasive, which is thoroughly broken down until no cutting action is left. This is done by running the lapping plates together until the abrasive particles are so reduced in size that when a test block (a reject gage block is generally used) is rubbed across the lapping surface, no scratching or abrasion is apparent. These lapping plates now have a finish approximating an optical finish.

Final lapping is done by rolling abrasive only. Levigated aluminum-oxide abrasive of two-micron particle size is used. This abrasive is suspended in a heavy technical grease oil to a consistency of heavy cream and applied to the lapping plates with a soft clean cloth with

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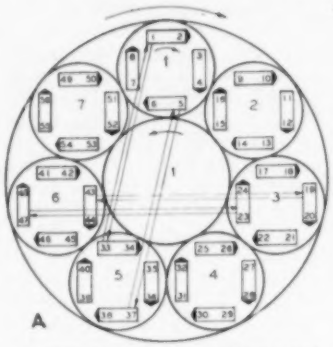

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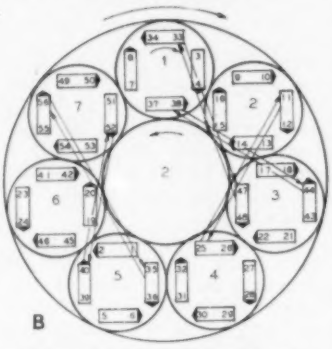

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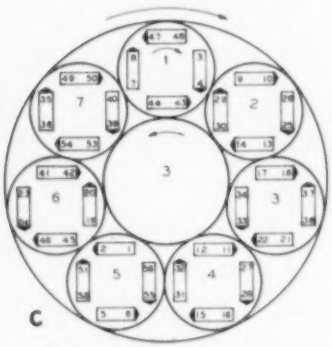

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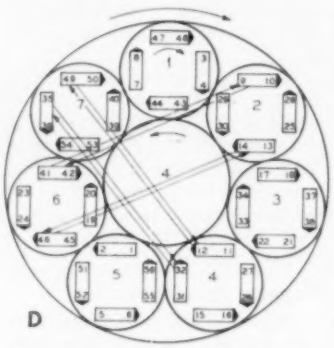

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a rotary scrubbing motion, leaving an even light film of oil and abrasive on each lap plate. Extreme caution must be taken that the lapping fixtures, the hands, the machine, and all things coming in contact with the machine are scrubbed clean and free of foreign abrasive.

The rolling action of the fine abrasive wears away the surface imperfections without introducing new scratches. The pitting effect of the particles first attacks the peak irregularities of the gage face, bringing the entire surface into one plane. As the peaks wear away, a greater area of contact is exposed and consequently a lower unit pressure occurs. At the same time, the abrasive is being broken down. These two factors cause a gradual tapering off of the attrition, and consequently a near scratch-free surface is obtained.

After finish lapping, the size, serial number and name are etched into the block.

Final Inspection

Inspection of the finished gages involves sorting the gages for quality in respect to five basic requirements.

Calibrating for Exact Size—In any discussion of the precision lapping of gage blocks, the term "millionth of an inch" is used quite matter of factly. The gage block maker works to accuracies one hundred times closer than one ten thousandth of an inch. The millionth is his largest unit. The standard or block he compares his work with is one which has been certified by the bureau of Standards and is either ± .000000 or its deviation from ± .000000 is known.

These working masters, are in turn, checked by comparison with blocks called masters. The masters, in turn, are checked by comparison with blocks called grand masters. Working masters are recalibrated weekly. Masters are calibrated once a month. Grand masters are calibrated by the Bureau of Standards every three months. All blocks used as master standards have an original calibration by the Bureau of Standards.

Comparison of master blocks with uncalibrated blocks is made

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using electronic or optical comparators, each graduation of the scale indicating 0.000002 in. The blocks must all be at the exactly same temperature. This is accomplished by placing the blocks and the master in kerosene or soda water for one hour per inch of length or fraction thereof. Cotton gloves are worn by the inspectors to shield against body heat but not for the purpose of handling the block. Blocks are handled by forceps.

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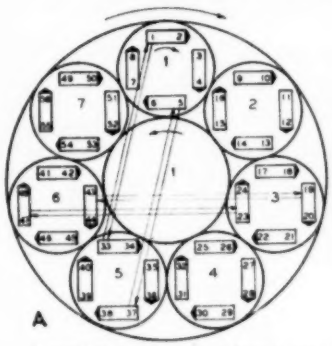

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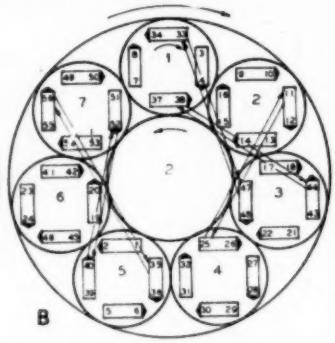

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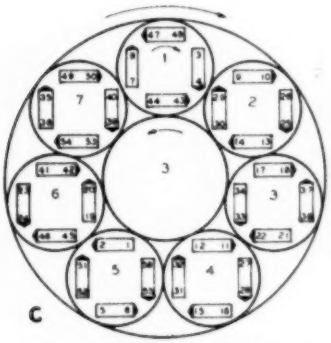

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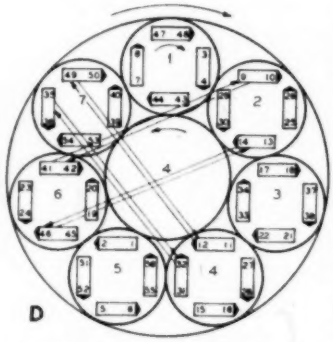

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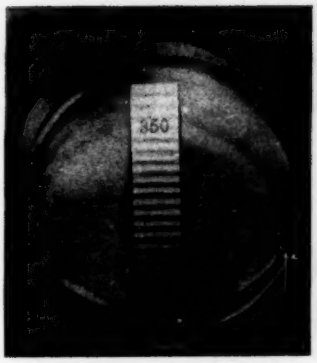

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John R. Godfrey, lamenting the vanishing breed of old-time toolmakers in a recent issue, draws the fire of four defenders of the present-day ones

Here Are the Toolmakers

BY E. R. RALLS

"WHERE are the toolmakers?" Now *there* is an easy question to answer! They are in the toolroom where they belong—making tools, not designing them.

John R. Godfrey gives a long, low howl of lament for the old-timers. (*AM*, Nov. 17, 1949, p. 100). This is one more nostalgic protest that toolmakers no longer combine the attributes of tool designer, engineer, estimator, and last, but not least, the rare talent for producing accurate tools in minimum time.

In the process of bewailing the sad state of affairs, Mr. Godfrey manages to give a few subtle, and some not so subtle, digs at tool designers. It appears that his experience with tool designers has not been entirely happy. For one thing, for obscure reasons of their own, they have been placing half-thousandth tolerances on dowel-hole locations.

As I have produced and checked thousands of tool drawings, it seems strange that not once have I run across such tolerances. In fact, I have never seen *any* tolerances on dowel-hole locations. These are always given in fractional dimensions. Could it be that Mr. Godfrey has not been dealing with the right tool designers?

In Mr. Godfrey's day, a toolmaker could "Look over a piece of work to be made and fudge-up a tool that would make it. . . ." It has fallen to the author's dismal lot to look over a great variety of such fudged-up tools. I have often thought that a museum should be set up to preserve such quaint Americana for posterity.

This probably sounds like heresy. We are all accustomed to hearing how the old-time toolmakers were wizards, when compared to the dud-heads of today. In my opinion, it isn't true.

If "fudging up" had been the best and most economical method of producing tools, it would still be in use. The fact that all progressive companies support large tool-design departments proves that the practice is the most economical method of solving the tool problem. Few philanthropists head manufacturing plants. Methods are available to check, almost to the penny, the relative merits of well-designed tools, versus haphazard toolmaker tooling.

Too Busy for Resentment

This, believe me, is not said to belittle the toolmaking trade. On the contrary, my hat goes off to countless toolmakers who, day after day, are doing a great job of advancing our standard of living. Fortunately, they go about their business oblivious of all the jibes aimed their way; namely, that they are inferior to their predecessors.

It seems inconceivable to me that anyone could say that it would be more economical to fudge-up a tool than properly to design it first. Anyone at all familiar with tool engineering will realize that 99 times out of 100, the first design, upon study, will prove inferior to succeeding designs. When the tool is immediately built, the first draft is the one used. It is never mentioned how many fudged-up tools are built before the one that works.

About six months ago, I looked over a die for producing umbrella clips. Although crude in appearance, the die seemed to do a good job. In fact, I was rather surprised to learn that it had been worked up by the diemaker. After the proper congratulations, I turned to go when a pile of dies on the floor caught my eye and I asked what they were for. It turned out they were the dies that proved unsuccessful for the job. If the problem had been brought to a competent die designer, and built by a good diemaker, the part would have been in production months before, at a fraction of the cost of the scrapped dies.

What has been proved? Exactly nothing. But, when examples such as this occur in several shops and are multiplied, great waste is evident.

Many persons would have us believe that the average tool designer is completely unaware of the problems of the shop. Nothing is farther from the truth. Any tool designer worth his salt can put on a shop coat, get on the machines and build any tool he has designed. The speed might not be there, as he has been away from the game for some time, but he'll get it done. He has served either a full apprenticeship or worked long enough in the shop to become well acquainted with equipment.

The vast manufacturing expansion caused by the war has unfortunately brought many incompetents into the profession. However, once the deadwood is cleared out by competition, the tool-engineer-

ing team of tool designer and toolmaker will step into its greatest era as an indispensable part of modern production.

BY R. E. MOULTON
Superintendent Experimental Fabrication Dept., Jet Propulsion Laboratory
California Institute of Technology

I THINK you will find the toolmakers where you have always found them; that is, in shops with good working conditions, fair wage scales, and interesting work. I believe that our small shop meets those qualifications.

The machine shop of the Jet Propulsion Laboratory employs 35 men. We are called upon to manufacture a very wide variety of research apparatus that calls for a high degree of ingenuity on the part of the men.

I am not qualified to state how many of our men could be classified as tool and diemakers of the type described. But I do know that at least one-third of them are capable of "looking over a piece of work to be made and fudge up a tool that would make it accurately, in good time, and using the machine equipment available." This is not entirely due to good fortune.

Our policy is to work a man to the limits of his capabilities whenever possible and through instruction and guidance to extend these limits. A few of our men had enough background and experience so that little or no training was required but most of them have been developed through these methods.

Our work is demanding and in many cases unusual and we are working with practically every known alloy, steel and aluminum. The man is handed the drawing and material, the function of the part is explained to him, machining procedures and tooling are discussed. After the man has a complete understanding of all requirements, he proceeds with the job and is free to create the necessary tooling. Most jobs are non-repetitive so that a premium is placed on simplicity and ingenuity.

My point in discussing the situation in our shop is to show that good mechanics can be developed, and that it is expecting a lot to hire such men at the gate. Develop the talent available in your own shop and you won't have to put up with the attitude: "I'm no tool designer. Bring me drawings of the tool and I'll make it."

Actually there is no tool designing department in our organization nor is there a qualified tool designer in the design section. If a complicated tool is required, our department furnishes the design section rough sketches of the tool and they detail it from our sketches. This, however, is a rare occurrence as most tools are made by the men from a verbal discussion with the foreman. What we have done can be done by any shop with working conditions such that they attract intelligent, interested men who are willing to work to develop their capabilities.

BY DONALD E. YOUTZ

WHAT has happened to the country since that "glorious past" to which Mr. Godfrey lovingly refers?

Unless the records are wrong, there has been advancement in speed and efficiency of production manufacturing. In fact, anything on the market today must be produced efficiently or it does not stay on the market.

One of the largest factors in this advance has been better tooling. It is problematical where the ideas for that tooling come from. Maybe they copy those jigs and fixtures which were "crude but fitted the work." Or maybe they are the result of advanced thinking. It is a safer bet that "they fit the work" but are far from crude, and the men who make them know exactly what they are doing.

If Mr. Godfrey is the victim of competition from present-day industrial empires, do not let him take it out in print on tool designers and toolmakers. If the fixture is going to "cost more than he will make on the whole job" there are only two conclusions to draw: either the job was small and was underbid in order to compete, or he got hold of a tool designer that did not know his business.

In either case I can't see where anyone but Mr. Godfrey is to blame, and setting up this cry about toolroom supermen is nothing but protest against his own mistake or against the industrial economy of the entire country.

BY HENRY GEORGE

THIS SUBJECT is dear to the hearts of us "old-timers." Like others I tried to find the answer—then realized that a great change has come over the art of toolmaking in the past few decades.

Yes, toolmaking "ain't what it used to be" when the boss would hand over problem jobs to a toolmaker to be solved with whatever tools and equipment were at hand. Then shop overhead was not so high, and no one objected to the toolmaker using a lathe or grinder or other machine at will—for fear he might upset "work schedules."

We all know that operating costs are now high, that much capital has been invested in tools and equipment. Some machines are so highly specialized that specialists are required to operate them. So, instead of having toolmakers who can operate every machine in the shop, we have 'toolroom machinists," and much of the preliminary machine work is done before a toolmaker gets the job to put a tool or die together.

Today's toolmakers are not given much opportunity to visualize the complete job to be done by his tools. Jobs are now broken down into many operations, each in the hands of a specialist.

A lot of the "old-time toolmakers" are retired or perhaps are running small tool shops of their own. Being old-timers, they take the responsibility of designing the tools themselves in the good old-fashioned way of making pencil sketches for the boys in the shop. They don't need to go to a tool designer as did Mr. Godfrey's small-shop boss.

The highly specialized method of toolmaking today, even in small shops, is, I believe, the result of standardization of details. For a toolmaker to take advantage of economies of standardization, he would need all sorts of catalogs and data sheets. These, we must agree, belong in an office and not on a workbench.

Toolmakers and hobbyists work side by side, each at his own project. Rates for machines are based on original cost, frequency of use, power drawn, and space required. An evening seldom costs more than four dollars; atmosphere is friendly, clublike

SMALL SHOP FOR RENT

Everybody wants to run machine tools.

Here's how one man lets anybody do it cheaply—

while the users pay his bills

BY WM. M. STOCKER, JR., Assistant Editor

ARE YOUR machine tools running at full capacity? Or are you a victim of this *"healthy readjustment of a once abnormal and unadjusted economy in a state of flux"*? If the latter is the case, you might try this fellow's idea, earn extra income—and have fun besides.

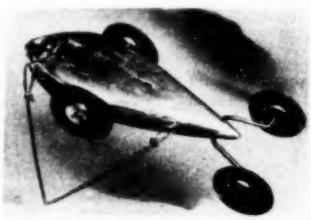
At the end of World War II, a toolmaker working on extrusion dies for Aluminum Company of America's plant in Edgewater, N. J., felt that he would like to develop some of the ideas he had gathered during the war. Diligent searching for a shop that would allow him to use its tools proved fruitless. Either the answer was a flat "No" or the tools necessary to complete a job were too scattered for practical use. Experimental development by an individual was apparently stymied.

Xelphin Dugal, our man with ideas, felt that perhaps there were many other folk whose ideas were dying for lack of expression. He decided to set up a shop for just this purpose. Not only would this provide the tools that *he* needed, but might pay for his groceries too. The first problem was to find a suitable place, with strong floors and reasonable rent, plus convenient location. After considerable effort, a place was found at 682 Avenue of the Americas in New York City. Previously vacated by a machine shop, the shop had reinforced floors and three-phase power supply. Rent was reasonable; the location ideal. Problem number two was acquiring the necessary machine tools. Selection, from new and second-hand sources, was carried out with great care. Each machine was thoroughly inspected before purchasing.

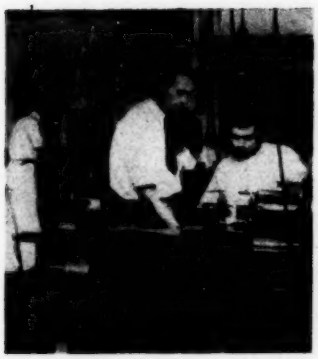
Birth of an Idea

Zelf Tool and Die Works opened its doors to the public thirty months ago. Magazine advertising and a local hobby exposition resulted in a turnout that quickly substantiated Zelf's idea. People do want a place to try their skill at working metals. Then something else happened! Retired toolmakers and machinists came in with jobs given them by old friends who knew their skill. All they needed to earn an income was a shop, and here it was. One man, an expert grinder, grossed nearly $40,000 last year contracting for those plus - nothing, minus - 0.0001 - in. jobs that no one else would touch. On one job he scrapped one piece out of 550, of which the purchaser had allowed 50 for scrap.

Machine tools available include seven engine lathes, one a 24-in. Monarch; universal millers, a planer, drillpresses, bandsaws, surface and cylindrical grinders, an engraver, and a buffer, plus most of the accessories necessary for efficient operation. There is also equipment for electric and acetylene welding, a hydraulic press for hub sinking, and a number of workbenches. All of this is available at very reasonable charges—from 25 cents per hour for use of a bench to a maximum of $2 per hour for the planer. Tools such as drills less than ¼ in., cutters, taps,



Prize-winning, gasoline-powered, model racer is a product of one hobbyist's ingenuity. Other developments include scientific instruments, patent models, special tools, and commercial products



Instruction, patient and friendly, is always free for the asking. Many novices, at first hesitant and afraid of machine-tools, are now capable machinists. These lathes have since been relocated to make room for a 24-in. Monarch with an 8-ft bed

files, and saw blades, are usually supplied by the customer, although some standard sizes are available in the shop. Inspection and layout equipment necessary for most work is provided free of charge by the shop to people using the machinery.

Maintenance is accomplished entirely by the owner, who puts in 14 hours a day, six days a week. A firm believer in preventive measures before trouble occurs, Zelf keeps each machine in top-notch working condition. Strangely enough, experience has shown that most trouble and damage to machinery is caused by people in the trade who should know better; seldom by beginners. Also, the majority of customers are honest. They will immediately report tool or machine damage; rarely take anything not their own property. However, scales, 1-in. mikes, scribers, etc. disappear regularly —not by intent, but by unconscious pocketing.

Zelf has no employees, therefore no labor problem. He needs to carry only liability and fire insurance to protect himself. When a job is brought in by someone who hasn't the time or the ability to do the work himself, he is introduced to a capable "regular" mechanic; it is then a matter strictly between the mechanic and his customer. Beginners who want to learn are shown how to plan a job and how to operate the machines they need. Advice, simple or technical, is free.

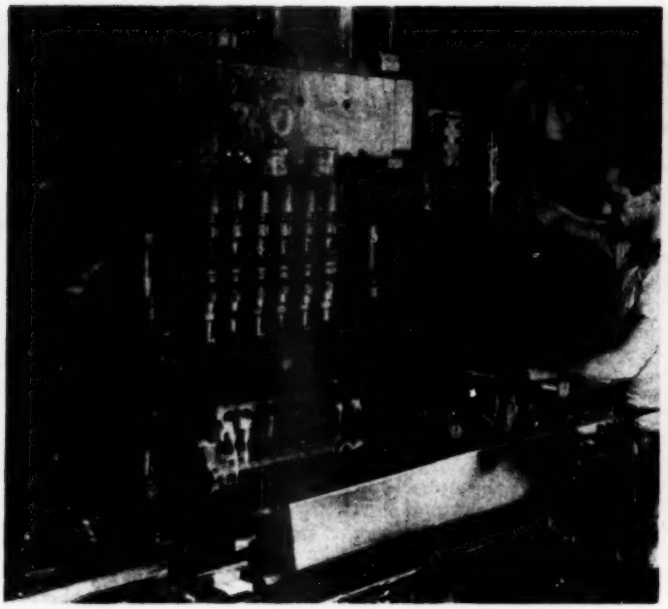
All Kinds of People

People from all walks of life take advantage of this metalworking mecca. Brokers, doctors, lawyers, artists, actors, business men, engineers, all try their hand at creating, some as a hobby, others to work out inventions. Then of course, there are those who depend on it for income, retired machinists, men from small shops not equipped for large work, and contract toolmakers. Unfortunately, very few young people take advantage of this opportunity. One boy, age 12, is a regular customer. Starting without any knowledge of machine tools, he now builds prize-winning internal combustion engines for model airplanes. Most fellows of high-school age use the shop to complete overdue school-shop work, but seldom return. Among the adults who use the shop, one plant manager said, "Here I can work out experiments which I'm unable to do in my own plant. Union contracts prohibit my operating our own machine-tools." A mechanical engineer feels that his shop experience is helping him produce more practical designs at his regular job.

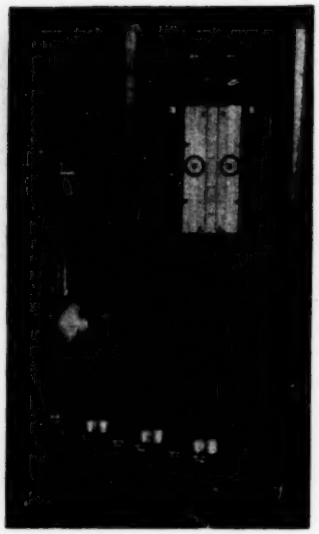
American individual enterprise is aptly demonstrated many times over at this shop, which in itself is a real example. During its existence many men have entered with an idea and gone forth with a working model—to profit by their effort. However, there is a firm policy to never praise nor condem any idea. Only the world can finally decide the worthiness of a project.

Present major problem at Zelf is lack of space, particularly for assembly purposes. Machines, such as one for packaging now being assembled, require plenty of room. Plans are now in process to acquire a larger shop. This will include space for more machines, a drafting room with tables available at nominal rental, and a group of small, individual rooms fitted for benchwork. The owner hopes eventually to hire a professional engineer and a draftsman for the convenience of and assistance to his customers.

"Junior! Must you keep playing with that infernal mechanical toy?"

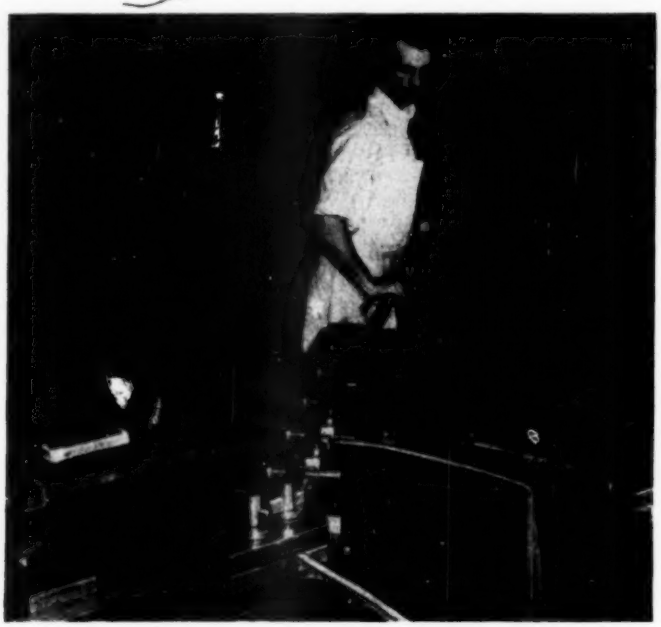


Cool honing produces auto-engine cylinders with bores accurate within 0.0004 in. of roundness and good enough on eccentricity and taper to *eliminate* rejects. New water-soluble coolant (mixed 20 to 1) and new abrasive sticks in the machine hone properly, without heating. Cylinders are also clean when they reach honing stations because solution is employed in engine-block seating and tapping. Honing time now takes 7½ sec instead of 16. *Studebaker*

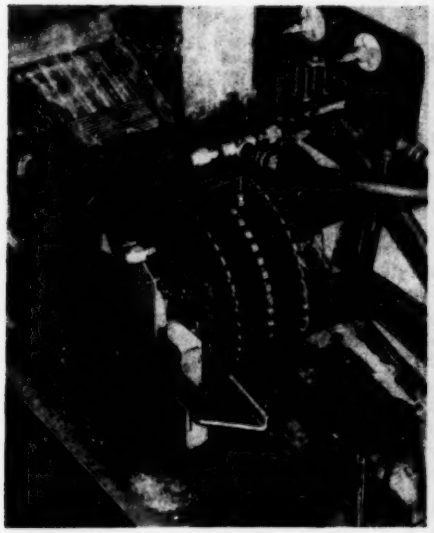


Lack of taper and concentricity in cylinder bore are indicated by circled air-gage indicators. Less wear and truer contact in cylinders honed by new process were indicated by 50-hr, 4500 rpm, full-load test

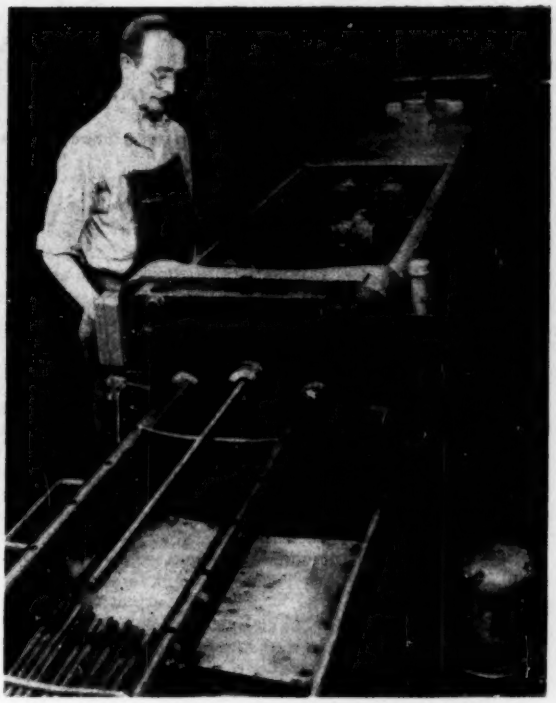
SHOP SHOTS



They said you couldn't do it, but here it is: Two 1/16x⅝-in. copper straps for a motor field coil are bent edgewise to 45° with little distortion. Two-inch strap (0.032 in. thick) has been bent to similar angles, losing 2 tenths' thickness on the outside, gaining 2 on the inside, and being drawn to 1⅞-in. width. *Westinghouse Electric*



Machined pushrods for Oldsmobile valves are turned out at 3000 per hr on a special automatic-machine lineup. After bar-stock cutoff, end forming and burnishing, and trimming, the rods go to the induction-heating machine where rod ends are treated and quenched. Entire production flows through this one machine. *Diesel Equipment Div.*



Odd diameters of copper-alloy rod do not have to be stocked for small, special jobs when a few standard diameters on hand can be drawn down to required sizes. Horizontal broaching machine with 10-ton capacity and 90-in. stroke has special gripper jaws and draw dies developed during war. Typical job is reducing ¾-in. stock to 0.642 in. in four draws. *Allis-Chalmers*

Hoist overloads more than 5% are prevented by a heavy die spring inside a steel housing added to the lift. If the spring compresses completely, it trips a solenoid that opens the motor circuit and snaps on the automatic brake. Power can then only be turned on to control down travel. *Solar Aircraft*

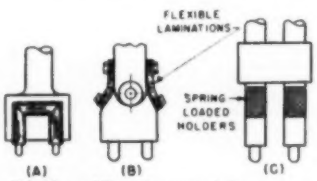
TRICKY TECHNIQUES HELP

Time and money saving tricks will keep resista..ce welding equipment operating at top efficiency

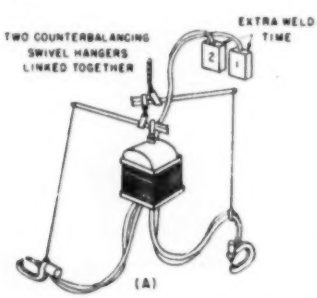
BY WALLACE A. STANLEY, Director of Production Design, PROGRESSIVE WELDER CO.

IN the operation of resistance-welding machines, many short cuts and special techniques are developed and employed by operators and tooling engineers. A few applied ideas and techniques which have proved helpful in increasing the use of resistance welding are illustrated here to stimulate the development of further ideas useful in manufacturing plants. Some techniques save money, others time, while others save wear and tear on machines and personnel or enable the job to be performed more easily.

One of the most useful tricks is making two spot welds instead of one on a standard machine. They can be made simultaneously by two individual tips, but these



Double welding tips may take a number of different forms, but must be designed to be self equalizing for proper pressure and current distribution



Two portable guns can be operated from a common transformer. Two or more switches mounted on the gun handles permit a choice of weld time settings to suit the work

should not be rigidly held in a common holder because pressure and welding current cannot be satisfactorily equalized to produce consistent, equal welds from each tip. There are several ways of making the tips self-equalizing to take care of inequalities in the metals or in the weld. They may be slidably mounted in graphite-lubricated holes with a horizontal equalizer rod bearing on the beveled upper ends; they may be mounted on a rocker with flexible laminations conducting the welding current; or they may be carried in commercially available spring-loaded holders. The latter type is commonly used for multi-spot welding on press-type welders, and the traveling upper plate may carry as many as five or six holders.

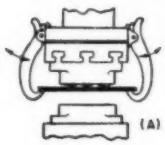
With portable gun-type welders, it is entirely feasible to operate two guns from a single welding transformer and a single set of electrical controls. Each gun may have an individual pilot switch to produce independent weld times. This is accomplished by auxiliary relays and is desirable in many applications because the two guns are usually of different construction and are often used on different combinations of metal, requiring variation in weld time.

Such settings can be prearranged by individual switches which will automatically apply the correct weld time for the particular gun being used. Two or more switches —called dual weld switches—may be mounted on handles or at other convenient locations so a choice between weld time settings may be preselected by the operator.

For example, if one gun is welding 16-gage steel while the opposite gun is welding 20-gage, each would be adjusted for the proper weld time. However, by the dual arrangement of switches, each gun can optionally weld either the 16-gage or the 20-gage at will by depressing the switch for the weld time of that particular gage of metal.

A similar arrangement can be applied to a standard press welder by two foot switches. The machine can thus accommodate various combinations without recourse to the control cabinet to adjust weld time for each.

These multiple-choice switches permit a great variety of production to be accommodated on the same machine. For example, in welding two 18-gage reinforcements to a panel, one switch is used. When a 14-gage reinforcement is to be welded to the same panel, the other switch is depressed



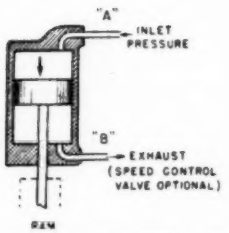
Simple, homemade arrangement of two swinging hooks will slide over edges of work on down stroke of platen and will lift it clear on the return stroke, saving the operator from pulling the work off the dies

without even stopping the machine.

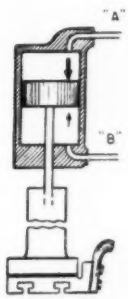
Extensive use of extra handling aids in conjunction with welding machines is to be encouraged for such functions as ejecting, lifting and indexing. The equipment can be similar to that commonly used on punch presses, and may include automatic lifting hooks, ejectors operated by cams, cylinders or springs, discharge chutes, stackers, and various types of magazines and hopper feeds.

Condensed from the forthcoming book, **Resistance Welding,** *by Wallace A. Stanley, to be published by McGraw-Hill Book Co., 330 West 42nd St., New York, N.Y.*

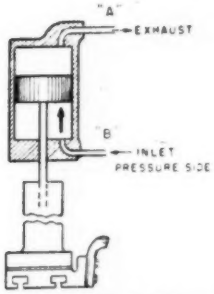
RESISTANCE WELDERS



Conventional arrangement of piping for air cylinder of a resistance welder. Speed control valve may be connected to exhaust to cushion the down stroke and reduce shock of moving head



Low effective pressure can be obtained by altering the piping arrangement to admit reduced-pressure air to lower side of piston while retaining sufficient top pressure to operate valves and controls



Reversed positions of inlet and exhaust lines permit partial counterbalancing of the weight of the ram to produce extremely light operating pressures for special techniques

Rearrangement of the air-cylinder piping can also be carried out to produce results other than those intended in the original construction of the machine. With the normal setup, pressure is applied to the work by the combined weight of the ram and the full applied pressure of the air. There are some applications, however, where this pressure is excessive, as on welding special alloys such as Everdur, or in some special techniques. Air pressure can be reduced, but trouble will be experienced with the valves and controls if pressure is below 15 to 20 psi, or a minimum pressure of about 500 lb.

An easy way to overcome this difficulty is to feed air at reduced pressure into the exhaust line. The net effective pressure on the ram will then be equal to the difference between the inlet and exhaust line pressures, and may be adjusted between zero and full supply line pressure. Whatever the differential, however, there will always be sufficient inlet pressure to operate the controls.

To achieve less than ram weight pressure and still utilize reasonable air pressure, air may be admitted to the under side of the piston only, the pressure being adjusted to counteract ram weight to the desired extent.

Interchangeable Parts

It has been found advantageous to standardize on sizes and types of electrical controls and component parts so quick interchangeability can be effected. It is not implied that electrical controls or parts should be obsoleted in favor of one or two manufacturers, but it is advised that interchangeability be achieved, even with the various manufacturers' sizes and types.

When complete interchangeability is not permissible, partial interchangeability is desirable. It is easy to achieve this if all the controls of one type are used in one department while controls of another type are used in another department.

The multiple-terminal plug is being increasingly adopted to permit pre-wired controls to be interchangeably used because all wiring is terminated at the same position in the plug and socket.

Multiple-terminal plug permits prewired control units to be installed with minimum time loss, and aids interchangeability

The use of identical terminal strips is also advantageous in familiarizing electricians with terminal numbers and operating functions, and facilitates ready diagnosis of trouble in the various circuits.

Self-sealing, quick disconnect hydraulic couplings can be used to permit rapid disconnnecting of lines without loss of hydraulic fluid or water. They eliminate the necessity for bleeding the lines, as with ordinary couplings.

Use of such couplings is also advisable for portable hydraulic welding guns where the hose joining the booster to the gun is removable. The entire gun unit can thus be disconnected from the transformer and booster and removed to other locations. These fittings are a valuable aid in quickly changing tip holders.

Electrode tips and tapers must be kept in good condition, and a number of dressing tools are available. The job may also be done on a lathe with suitable form tools to suit the tip shape desired. For seam welding wheels, side scrapers and cutters can be attached as auxiliary equipment to trim the face and restore it to original size and contour. Pickup accumulated on the wheel surface may be re-

moved by a small, high-speed wire brush. These homemade dressers are production boosters and make seam welding simpler and cheaper.

Deflector Tubes are Important

One of the most common errors in water cooling regular welding

Homemade wheel-dressing attachments help to maintain correct form and cleanliness of electrodes and simplify seam welding operations

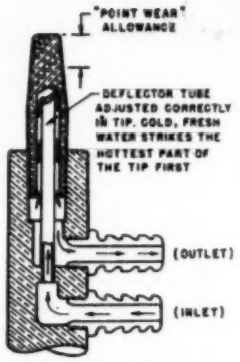
tips is to overlook the relation and importance of the water deflector tubes and their effect on water passage in the electrodes.

The deflector tube, the long, thin-walled tube which conducts the fresh water from the inlet port of the holder, is supposed to be inserted as close to the end of the drilled hole in the tip as it is possible to place it, so fresh cold water will contact the hottest portion of the tip to transfer the heat into the water and dispose of it through the outlet port.

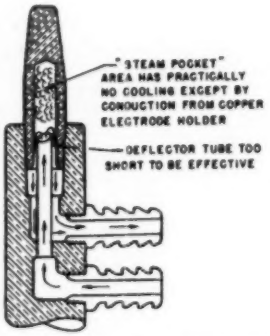
If the tube is too short the heat is not conducted into the water, and a steam pocket results. The heat canot be dissipated and there is practically no cooling except by conduction from the walls of the electrode through the walls of the holder. This condition is one of the errors frequently found in installing electrodes. Very short life of tips, instead of a long useful life, will result from poor cooling.

An even worse condition is that of omitting the deflector tube entirely. When this occurs, the water circulates from the inlet directly to the outlet ports without entering the dead area in the drilled hole in the tip. This dead area has no cooling effect and solid tips might just as well be employed as hollow electrodes, as there is no water circulation.

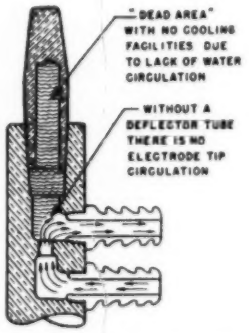
The standard holder is often equipped with a stationary or fixed deflector tube which will not readily permit the use of various depths of drilled water-cooled tips. In


"POINT WEAR" ALLOWANCE
DEFLECTOR TUBE ADJUSTED CORRECTLY IN TIP. COLD, FRESH WATER STRIKES THE HOTTEST PART OF THE TIP FIRST
(OUTLET)
(INLET)

Correct setup of deflector tube brings cold, fresh water into direct contact with hottest portion of the tip and insures maximum cooling effect


"STEAM POCKET" AREA HAS PRACTICALLY NO COOLING EXCEPT BY CONDUCTION FROM COPPER ELECTRODE HOLDER
DEFLECTOR TUBE TOO SHORT TO BE EFFECTIVE

Deflector tube too short. This permits formation of a steam pocket, reduces cooling and appreciably shortens the life of the electrodes


"DEAD AREA" WITH NO COOLING FACILITIES DUE TO LACK OF WATER CIRCULATION
WITHOUT A DEFLECTOR TUBE THERE IS NO ELECTRODE TIP CIRCULATION

Omission of deflector tube stops all water circulation in the tip. Dead area thus produced has no cooling effect whatever

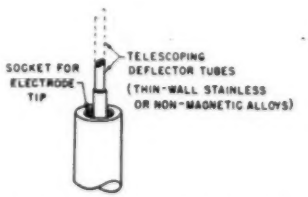
such cases a thin-wall stainless or non-magnetic alloy tube can be inserted to form a variable height, or telescopic, tube.

Further in connection with cooling water, it should be noted that adding a 5% borax solution to a recirculating system, will prevent rust from forming in the system; or on the work, in the case of seam welders. Booster pumps increase water pressure and production when pressure is too low, as on high floors of a plant. However, pressure will do little good unless accompanied by an adequate quantity of water, so if there are too many welders for the water line, pressure booster pumps will serve little purpose.

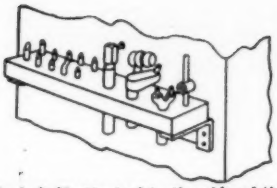
The commonly applied recirculating (closed) system conserves water by cooling and recirculating it continuously. The system must have sufficient cooling capacity, pressure and flow to permit full-speed operation of the machines. Recirculating systems have conserved millions of gallons in communities where water is too expensive to throw away.

Thermostatically controlled water valves will save hundreds of thousands of gallons of cooling water by shutting themselves off when no heat is being added to the water, as when machines are idle. The valve will open and close automatically with the need for dissipating heat in the circulatory system and in accordance with the duty cycle at which machines are being run. Thermostatically controlled valves will pay for themselves in a short time on applications where water is at a premium, or where machines are not used enough to warrant wasting water.

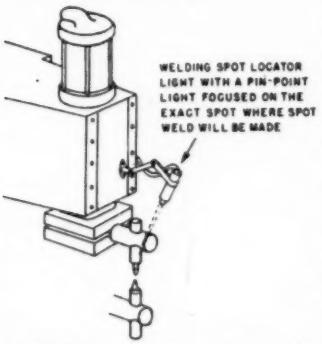
An effective (though often controversial) method of achieving



Telescopic deflector tube is a useful accessory for applications requiring frequent changes of welding tips



Tool shelf attached to the side of the spot welder provides a handy storage place for tools and spare tips and saves considerable setup time



Spotlight with pin-point focus aids in locating exact spot for welding and is particularly useful when regular spotweld locators cannot be provided

consistent production in repetitive welding operations is to lock the door on the electrical controls and keep the key in the custody of a responsible setup man or welding supervisor. Usually the locked controls have been found most advantageous when the door has a glass front so control settings can be observed but not touched. Locked control cabinets have a strange record of keeping higher production rates and consistency through fixed settings. Their records have been much more remarkable than those controls where opening and changing by many individuals has been allowed.

Adding to a Loaded Circuit

In situations where a power line has almost reached its capacity and has a limit of one more welding machine, the impression is that only one more machine can be connected. However several machines can be connected to the power line and still remain within the capacity of the single welder by permitting only one firing circuit to be operated at one time, while locking out the others.

The interlocking is done on the firing circuit only, and will permit sequencing operations of the various machines to be conducted independently of each other, but still withhold passage of current through a machine until there is no other machine firing.

The operation of the machines will be only slightly slowed up by the interlocking relay system. The operators will hardly be able to detect any difference in the normal speed and operations. The welding time is only a small fraction of a second, and therefore the interlocking of the firing controls will delay the operation by only this amount.

The American Institute of Electrical Engineers has regular installation formulas for line loading conditions, and the services or consultation of electrical installation engineers should be obtained for proper arrangement of interlocks.

Installing a common hydraulic jack for raising and lowering the knees of press-type spot and projection welders, or sometimes even with seam and flash welders, will permit easy vertical knee adjustment. These hydraulic jack installations can be easily made on the job, if they are not factory installed on the machine. The cost is usually paid for in time savings in the first application, and they are so economical that they can be installed permanently.

One of the most effective accessories that can be installed is a spot weld counter to keep a record of the number of welds made. The number of welds will determine the frequency of tip dressings, and help record the tip life and facilitate the estimation of production. It will also indicate, by the number of welds made, when the next lubrication should be performed.

The type of counter is optional, as there are many commercial varieties on the market. Fundamentally the two types are the electrically operated counter, operated by an electrical impulse from the control each time the machine is operated, and the mechanically operated counter, usually by a pull chain and spring combination attached to the moving ram of the machine.

Counters are of far greater importance in maintaining proper care and operation of the machine than they are in keeping the workers busy on the job. It is important to emphasize this particular aspect because of the difficulties generally encountered in such installations due to the feeling of operators against checkup on individual production.

Perhaps one of the most important tools in the welding department, but one which is unfortunately not used enough, is the electrode force gage. These are used for accurately determining the actual pressure on the electrodes. Ordinarily, the net pressure on the tips is in conflict with the calculated (nameplate) pressures because of friction of the ram, packing in the air cylinder and many other factors.

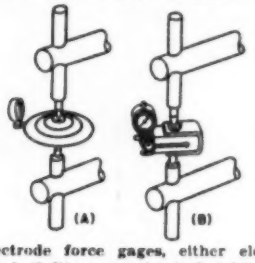
One of the essential factors in the use of an electrode force gage is the absolute necessity for turning the welding power off while it is in use. Inasmuch as the gages are relatively expensive, and are instantly ruined if the welding current is passed through them, it is foolhardy to use them with the power on.

The hydraulic type is a sealed enclosure in a special diaphragm container completely filled with fluid. The application of tip pressure exerts a compressing effect on the diaphragm and causes the indicating gage to show the effective pressure applied.

In the mechanical type a special precision-made U-shaped fork of special alloy steel is placed beneath the electrode. Pressure is then applied to the welding tips and the actual springing of the fork is indicated on a strain gage having a special micrometer adjustment to indicate the pressure applied. The use of the electrode force gage is strongly urged for welder supervisors, and a definite part of the machine's record should be the testing "on the job" of the electrode force at various air pressures.

A valuable aid in keeping machines in top working condition is a maintenance and repair cart which is usually a homemade affair.

Such carts usually contain: Pull test equipment, hammer and vises, weld test equipment, extra hose, cables, tips, holders, instruments, testers, air, water and electrical fittings, drills, Morse taper reamers, tip dressers, spare parts, fuses, timer tubes, relays, and gages.



Electrode force gages, either electrical (left) or mechanical (right), are essential for checking actual pressure applied by the electrodes

Many times the cost of a maintenance cart has been saved on the job in the minimizing of down time or tip dressing time. The sizes used range from a small cabinet to large trailer types used to service and maintain large automotive welding machines containing several hundred electrodes and other parts.

Flexibility of a stationary spot or projection welding machine can be increased by attaching a portable gun. The gun should be suspended by suitable cables and counterweights, and the welding cables attached to the terminals of the welding transformer or as near as possible to the transformer secondary.

Use of the welding machine transformer and controls offers a considerable saving in original equipment required, if such use of a gun from the welding machine is satisfactory. The gun can remain connected to the welding machine and used alternately or intermittently with the stationary welder.

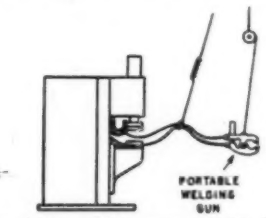
Two of the most important suggestions that can be offered concern the physical geometry of stationary welding machines. In the first place, the throat height should be kept at an absolute minimum. Inefficiency and wasted electrical power result when more height at throat opening is used than is needed. Maximum height opening should not be used unless it is necessary, because of the decreased efficiency and lowered welding capacity when the arms are in the open condition.

Similarly throat depth should also be kept at an absolute minimum to avoid wasting power and efficiency as the result of wasted throat depth. When the arms are extended to their full length, a lowering of pressure is usually necessary to avoid excessive deflection of the arms. The welding current capacity is also lowered because the increased secondary throat considerably increases the reactance of the welder.

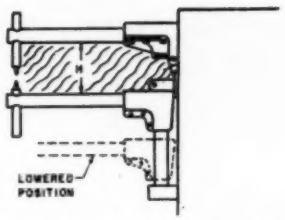
Machine Instructions

One of the most beneficial, economical and intelligent "tags" is one indicating what to do when the welding machine is shut down for various lengths of time. Power, air and water should be shut off, depending on the period, such as, (a) brief interruption only for dressing tips, (b) lunch hour or brief shutdown, (c) change of shift and other brief shutdowns, (d) overnight and for considerable periods of time.

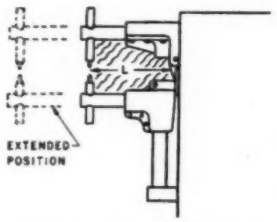
Maintenance cart with a supply of spare parts and tools insures quick servicing of faulty machines and saves lengthy down time



Portable welding gun connected to the transformer terminals of a stationary machine will save the expense of a separate transformer



Throat height should be held to the minimum that will clear the work. Excessive height reduces welder efficiency and lowers welder capacity



Throat length should be as short as possible to avoid deflection and prevent lowering of the welding current capacity by increased reactance

Such instructions should be clearly placed on a tag on or near the welder and should show how to shut down the machine briefly and for longer periods, and how to start up the machine, what to turn on and how long for warm up.

The basis for this suggestion of a special instruction tag is the author's observations of many costly and wasteful conditions:

(1) Water is commonly left on overnight, wasting thousands of gallons.

(2) Air is left on, sometimes permitting accidents during shutdowns and causing other undesirable conditions to arise.

(3) Extra warm up time is caused by pulling the wrong switch.

(4) Needless delays are often caused because one utility was forgotten in either starting up or shutting down the machine.

(5) Damage to the machine results from facilities left on when not in use, as for example, cylinder and valve packings under constant air pressure instead of at rest, or because bleeding instructions for hydraulic circuits are neglected.

When Metalworking Turned the Corner —and the Century

BY E. J. TANGERMAN
Managing Editor, American Machinist

JUST fifty years ago, American Metalworking began to shake off its swaddling clothes. At the Paris Exposition of 1900 we exhibited machines that were the envy of Europe—which had previously supplied almost all our equipment. Tool steel and electric power were broadening the horizon, the horseless carriage was dropping its whip socket to become the automobile and to create a new industry, faint glimmerings of sensible employee relations were creating production teamwork.

1900 did not start the new century—it ended the old one. But the layman thought it did, and its developments justified his belief. To show you how very far Metalworking has come in this half century, we draw in this Special Report a picture of American Metalworking in 1900, using extracts of the issue of *American Machinist* for that year to show the differences and the similarities between our hectic age and that sedate one wherein so many of today's developments were first conceived.

Where were modern presswork, high-speed machining, materials handling, broaching, welding, finishing, close tolerances, sound relations? Where were quality control, mechanization, mass production? What has become of the rigid shop regulation and relaxed prose of that era? In answering these questions, you will be able to draw your own picture of where we are going these next fifty years.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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Where Was America Fifty Years Ago?

Bryan was the perennial candidate, but by 1900 his silver-dollar act had become tiresome.

"By the statistical abstract of the United States our population at the beginning of this year were 77,000,000 and it cost $700,000,000 or $9.21 apiece to run the government for the previous year . . . the Post Office Department collected $1.25 per capita, and spent $1.38."

American Machinist, Apr. 19, 1900

POPULATION in 1900 was roughly half what it is now, in other words, and the Post Office was losing money as it is now. **The national budget was, however, about 2% of the present one.** William McKinley, a Republican, was in the White House, and was reelected that year, running against the silver-tongued —and silver-minded — Bryan. America adopted the open-door policy in China in January, the gold standard in March.

The people were riding bicycles, ten millions of them, and a million new ones were being built each year. Victor, Eclipse, Pope's Columbia, Stearn's Yellow Wheel, and Sterling were popular brand names, and the proper society was the League of American Wheelmen. The more affluent drove carriages, although the horseless carriage was the latest thing. The highest building, a skyscraper, was just 29 stories tall.

There was still much talk of the 10-week Spanish War, and sympathy for the Boers in their struggle against the British—but we joined in suppressing the Boxer Rebellion. The Klondike gold rush was at its height, California oilfields had just been discovered, the Floradora sextet was wowing 'em in New York, and on every man's moustachioed lips was the name of Lillian Russell. The common man was content with a good minstrel show, for movies were in their infancy. Honus Wagner was the best in the National League; the popular spectator sports were becoming college football and professional baseball. In Kentucky moonshining was well established to combat "revenooers" and the rising Prohibitionist movement, and the suffrage movement was rampant.

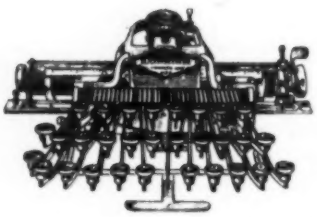
Cigars were the symbol of affluence; cigar stores displayed this rhyme prominently: "Cigarette smoke, like lighted punk, hath a fetid stink, like a lively skunk." Drug stores were dispensing sodas (but sundaes were unknown), and every major city was shifting to electric streetcars. At home, decorative iron stoves, portieres, fancy sofa pillows and wicker furniture were the rage.

Brown sugar was 5 cents a pound, pancake flour 8 cents, eggs 14 cents a dozen, butter 25 cents a pound, bread two loaves for a nickel. Wheat was only 70 cents a bushel, corn 33 cents, so whiskey was only $2 a gallon. A turkey dinner was only 20 cents, supper or breakfast 15 cents, and hotel rooms a dollar a day. Suits were $5.50 to $13, women's shoes $2 to $3, corsets 50 cents. There were no radios, aviators, income taxes, chain stores, city managers, rum runners, bolshevists, complexes, Rotaries, automats, nor cross-word puzzles. Carnegie was the greatest name in steelmaking, Rockefeller the world's richest man.

Edith Wharton had just written her first novel, Edison had perfected the phonograph, New York City was digging its first subway, Chicago completing its drainage canal. "Wireless" was the latest scientific word. Galveston's hurricane and flood, costing 5,000 lives, shared the headlines with the announcement that the yellow fever virus had been proved to be transmitted by a female mosquito.

Postwar Note

"The second sale of Mauser rifles captured in Cuba and Puerto Rico from the Spaniards took place at the Springfield Armory a few days ago, and 10,000 rifles and 5,000,000 rounds of ammunition were disposed of."—*AM*, Mar. 29.



Drum or wheel typewriters were one of the more complex products 50 years ago. This Blickensderfer model included a wheel made on a hydraulic press, the type characters being brought to sharp outline in the female die by putting a little water in the first-draw depressions before finishing

In industry, laundresses had invented the "sit-down" strike, female stenographers had risen from 7 in 1870 to 200,000, despite the "pitfalls" of business offices. Aluminum was being suggested for auto bodies and Heinz was developing the assembly line by hand-canning (in tin) some of its 57 varieties, and hand-labeling and wrapping the cans.

What About Labor?

WANTED—a good general machinist; steady work; wages $2.50 per day; married man with family preferred. Write, stating qualifications to manufacturer, c/o American Machinist.

Fifty years ago, the Republican Party was in the saddle, with Mark Hanna the business-minded political boss and McKinley in the White House. Slogan of the Republicans was the "Full Dinner Pail," which wasn't too difficult because business was increasing rapidly, production of wheat and corn was twice that of only thirty years before and prices were low. Uneeda biscuits, at 4½ cents a box, were among the first distinctively packaged, nationally distributed items.

Inevitably, labor was restless. Sanguinary strikes were relatively frequent. There was the familiar coal strike for a 10% increase—which the men won because Mark Hanna bluntly reminded mine owners that paying the higher wage rate was better than having Bryan in the White House.

Machinist unions struck too. Early in March, Chicago machinists went on strike because shop owners failed to sign an agreement which demanded, among other things, a closed shop, **minimum wages of 28 cents per hour, and 32½ cents for die and tool work,** time and a half for overtime up to 12 o'clock midnight, and double time thereafter and on Sundays, a 9-hour day and seniority in re-employment after a layoff.

An agreement between the National Metal Trades Assn and the International Assn of Machinists, signed March 31, 1900, in New York City, included among other points: Overtime rate is 1¼ times day rate until 10 PM, 1½ times from 10 to 12, and double time

American Machinist Turned the Corner Too

AMERICAN MACHINIST was the 23-year-old "Practical Journal of Machine Construction" in 1900, containing about 24 editorial pages a week, and as many advertising ones. Content included items on steam and power engineering as well as metalworking engineering and production. Said the editors in the final issue of 1900: "It was the first paper in America, at least, and probably the first in the world to be devoted exclusively to machine shops and to the interests of those engaged in the various branches of machine construction. Though the few earlier numbers viewed in the light of 23 years experience and by present standards seem rather poor things (there were in them few or no contributed articles and few if any engravings made especially for use in its columns) yet the paper had in it a vital principle, which principle may be said to have been founded upon the determination of the men who began it, to deal fairly and squarely with its readers and advertisers; to print advertisements only as advertisements; to charge everybody precisely the same price for the same service, and to confine the paper to its field."

The magazine actually was begun in 1877 as a 16-page, 11 x 15-in. monthly, costing $1.50 per year. Shortly, subscription price was reduced to a dollar a year, then the success of the enterprise caused it to be changed to a

weekly June 29, 1879, at a rate of $3 per year. The next change was to a combined magazine in 1901, the first weekly issue of each month concentrating technical material and available separately at $1 per year, while the whole weekly service cost $3.

Said the editors in 1900, discussing the old magazine: "Changes have taken place that make the successful paper of today a very different affair than what it was 23 years ago, and the expenses for contributed articles, engravings, editorial work and printing have been enormously increased."

Contrast between 1900 and today in writing and illustrative techniques is similarly marked. In 1900, the usual (and still infrequent) illustration was frequently a general shop view, inside or out. There were almost no specific illustrations, except an occasional drawing showing a shop kink or details of a new machine. Articles were long and involved, written in glittering generalities with frequent quotations from the classics. Phrasing was very polite, but very indirect. Instead of the modern trend to pictures and as few words as possible—and those specific—the effort seemed to be to impress the reader with the erudition of the author rather than his ideas. Paradoxically, most authors used pseudonyms. These characteristics will, I think, be evident in the extracts here quoted.

Drafting Was Once Uncomfortable

DESCRIBING a cast-iron drawing board developed by a bicycle manufacturer, the editors editorialized: "These of our readers who have endeavored to make accurate drawings in those cases where they are required, having the usual unsatisfactory appliances only at hand, may easily imagine the comfort with which such work may be laid out with such appliances as these. In saying this we mean comfort in a mental sense. In a physical sense, comfort would not seem to be a conspicuous feature of such work." What would they say of our air conditioning, fluorescent fixtures, lettering machines, special printers, and the like?

after 12 and on Sundays and legal holidays. . . . One apprentice for the shop, plus one for each five machinists. . . . **A week's work is to be only 57 hr after 6 mo from signing, and 54 hr after 12 mo.**

As usual, too, shop owners sought for a solution to the labor problem. In discussing overtime work to relieve rush conditions, one reader said, "In general machine work more than 12 hours overtime, excluding Sunday, per week of 60 hours is likely to cause dissatisfaction after a few weeks. For lower grade work this may be extended to 16 or 18 hours overtime per week for a limited period. If the demanded increase of product be large the only recourse is to run two or more shifts of men by which means the plant may be run continuously, although this is rarely advisable. . . . Machinery, like human beings, is also better off for an occasional rest, so that 20 hours out of the 24 ought not often be exceeded. . . . Night work at its best rarely pays in machine works."

Item in the Commercial Review columns for May 24, "The head of another machine plant, a tool-building works where between 400 and 500 men are employed, remarked not long ago 'I would gladly turn over to 9-hours time tomorrow if other manufacturers would do the same.'"

The Result

WANTED by a machine manufacturing company, 20 miles from New York City, employing 150 men, a competent person to introduce the system of piecework and economical methods of manufacturing. Only those having experience and ability need apply. Write American Machinist.

By shifting from a day-work to a "new-fangled" piece-work or premium plan, one manufacturer cut average cost per piece from $106.37 to $76.25, while increasing daily labor cost from $87.90 to $107.87. Wages rose from a high of $2.50 to as much as $3.70 per day for production workers.

Labor in Europe

American Machinist for Feb. 15 reports a new form of trade union applied successfully to the metallic bedstead trade of Birmingham, England. The two cardinal principles of the plan were: (1) selling at well-ascertained cost of production and, (2) cooperating with the work people in securing a fair profit. Under the system a manufacturer was permitted to sell his product at any price that suited him, but upon being called on to do so had to show that at the price there is for him at least a minimum profit, previously determined upon as fair, and he must pay to the people who work in his factory the standard wages agreed upon, together with a previously agreed upon bonus based upon profits. In theory then, the plan made certain that the manufacturer could not sell at a loss nor in fact at a price that gave him no profit, nor pay to his employees less than the agreed upon wages and bonus. **A board composed of equal number of employers and employees decided disputes and made or had made investigations of charges of underselling and the like. It also had the power to require forfeiture of money deposited by each manufacturer with the association in case a violation was discovered.**

Fred Miller, then editor of *American Machinist*, was in Paris for the Exposition of 1900. His reports frequently mentioned the laziness of Parisian workmen, their tendency to drink and smoke to the general detriment of the job. He said pointedly that while only an occasional workman smoked on the job, the others stopped work to wait for him to finish his smoke, and that "morning-after" heads resulted in stupid mistakes and lackadaisical work.

The *Cologne Gazette* interviewing an American machine-tool builder at the Paris Exposition, seemed surprised to find he "was a man of perfect education and clear ideas." Said the builder (*AM*, Nov. 22): **"The American workingman does not complain about mechanical improvements as do most of your men. He is always willing to operate several machines and has no objection to his employer putting two machines on the same driving belt.** The English workingman with his unreasonable demands is about to ruin the

industry, as is also the French. But I suppose this is the fault of the system practiced in Europe, as the very same man who makes obstructions in Europe and asks the impossible things, as soon as he emigrates and settles down in our country, breaks off with the whole nest of his European ideas and adapts himself to our system. We pay him better wages and treat him in every way as a man! Our system is good for both parties, the employer as well as the employee. In the shops of Europe, it is the employer and his managers who do all the thinking; we, however, train our men to think with us and for themselves."

Two examples of the "thinking for themselves": Tecumseh Swift in a letter Jan. 25: "An order by Charles J. Harrah, president, Midvale Steel Works, Nicetown, Pa., **requiring that every employee in the plant have his hair cut before his neck begins to be fringed with hair.** Men who ignored this peremptory order were forced to take a vacation until such time as they got a haircut."

"The Wabash Railroad, after paying its employees with checks for 15 years, is to go back to the old method of distributing cash from a pay car. The change is said to be made for the convenience of the employees and at their wish." —*AM*, April 26.

Sharp contrast with World War II pressure to keep every man and woman at work is expressed in this fragment from the report of an editorial visit to Springfield Armory: "During the Spanish war, many of the veteran workmen, feeling unequal to the necessary confusion and rush of increased hours of labor, retired to their homes, living in comfort on money at interest in the savings banks, accumulated during the long years of faithful and intelligent service. With the passing of the older men came the younger element. Two shifts of men were employed and for 22 hours out of the 24, the old Armory echoes with the sounds of unwonted activity."

Again: "Perfect harmony seems to prevail under Colonel Phipps' administration, he evidently knowing how to have things go along smoothly and efficiently without unnecessary friction, which we all know is a most important attribute of a successful manager."

1900 Employee Relations

"The Seventh Annual Oyster Roast (with all thereby implied) given to its employees and friends by the Berlin Iron Bridge Co. takes place at the works on the evening of April 27. The usual happy time may be expected to be enjoyed by all concerned."—April 26.

The modern concept of employee relations was beginning to rise, although the implication in the item above is more liquid than gastronomic. There were isolated reports of installations of suggestion systems, provision of employee lunchrooms, and the like. Here are examples: A correspondent in Hamilton, describing shop methods at Cincinnati Milling Machine Co., said employees got premiums of as much as $50 in gold for accepted suggestions, had two dining rooms serving hot soup and coffee, and a reading room for the 300 employees. They were also using wiping cloths instead of waste, providing clean ones each morning.

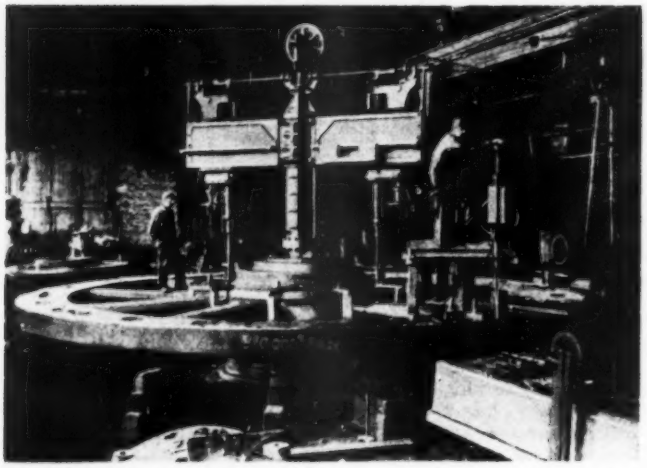
Cleveland Twist Drill put up a suggestion and complaint box, following the lead of National Cash Register Company of Dayton. The company offered awards from $5 to $50 as annual prizes. It also installed a reading room and library for employees which included a piano and a bookcase of books, so men could use unoccupied time during the noon hour. (Many current readers will recall that the suggestion box was one of the "hottest" of World War II employee relations ideas!)

Better Buildings Brought Better Work

Improving business conditions brought much new industrial construction. Even though the editors, describing a new shop for Potter & Johnston (Feb. 15, 1900), said, **"The building will be seen to be of a slow-burning construction which is so popular in New England,"** many changes were being made. There was better lighting, improved arrangement, better san-

Eager Beaver—1900 Model

"THE THOUGHT suggested itself to me to look up my time losses for the past year; having preserved all my time cards this was an easy thing to do. The total of these losses when footed up showed $39.90 for the year. These figures staggered me for I had never realized how quickly an hour lost now and then could run the dollars out. I know that my resolution to lose less time this year will bear good dollars-and-cents fruits. I also feel that I have discovered a source of income that I need divide with no one."—Sachem Parks. That was 13 years before the time of income taxes, 50 years before $39.90 was two days' pay.



Large flywheels require the machines to be brought to them, then as now. Here a double-arm radial drills and reams bolt holes in the hub of a 28-ft flywheel, while a single-spindle unit drills holes for rim plates to be riveted on. Note the driving belts and—horrors!—a worker sitting down. The photo was taken at E. P. Allis Co. in Milwaukee, during production of eleven engines for the power house of Metropolitan Street Railway, New York City

Before arc lights, Old Sol did the blueprinting. To get high-contrast blueprints (which we still don't!) Brown Hoisting & Conveying Machinery, Cleveland, built this special east-west gallery off the fourth floor. Note the plate-glass roof for the printing frames, facing due south. Twelve 24x36-in. prints could be made at once

itation and generally better working conditions. The lunch rooms and hot lunches were coming.

Cleveland Twist Drill Co., to overcome the difficulties of cold meals from lunch pails, established a dining room in one area of the shop wherein hot food was served to order and as many as 270 men could be seated (by number) at one time on benches with white oilcloth-covered tables. Men were divided into squads of eight, one of which acted as monitor or waiter for a term of two weeks. The monitor was provided with an apron and tray and allowed to leave his work 15 minutes early in order to get the lunches for the other seven men in the group. His apron had three pockets, one each for one, two, and five-cent meal checks made of hard rubber of different colors. Men bought meal checks from the timekeeper in quantities of 25 cents' worth or more.

Each day the men gave their monitor the order for the following day. The chef and his assistant were supplied by the company, as well as the space and the monitor's time, so the cost of meals to the men ran roughly: **Pea soup 2 cents; roast lamb 3 cents; stewed tomatoes 1 cent; mashed potatoes 1 cent; ham sandwich 2 cents; cheese sandwich 2 cents; bread pudding 2 cents; mince pie 3 cents; coffee 1 cent; tea 1 cent; ginger snaps or crackers 5 for 1 cent.**

Men were allowed only a half hour for lunch, so this system was stated to give them the maximum time for eating. The editors of *American Machinist* made this suggestion: "We note that many of the men go to the tables with their overalls on, and if we may be allowed to make a suggestion we should say that it would be better to remove them. Everything in and about a dining room where men take their meals should be as neat and clean as possible and this, of course, includes themselves and their clothing." Seems it would be a bit drafty with no overalls.

The editors felt it worthy of special mention to point out that, in the new plant of Gisholt Machine Company, thoroughly ventilated individual lockers were provided for each man and hot water was supplied for washing. There were also 12 shower baths, a radical innovation at that time. To avoid defacement and mistreatment, the lavatories (then called "flushing closets") were kept locked and an attendant assigned to provide keys and keep records of the men who used them, so that if one was defaced in any way a succeeding user could report it and

WE ALMOST HAD A TAX ON PATENTS TOO

A Mr. Reeves, chairman of the House Committee on Patents, introduced a bill by which "any person or corporation that shall manufacture any article, machine, device or thing hereafter patented, shall pay into the hands of the commissioner of patents for each of the things so manufactured, a sum of money not less than 1 percent nor more than 10 percent of the estimated cost of manufacturing, the royalty to be determined by the commissioner of patents."

Said *AM*: "This we consider to be one of the most foolish and ill-considered measures that have been proposed in Congress for some time. There are too many people who know nothing of the science of taxation, who seem not to know who finally pay all taxes and imagine that whenever any man or class of men are wealthy it is the duty of somebody to devise a new tax to be applied to them or to their business."

the preceding user would be held responsible.

Describing the new plant of the Lodge & Shipley Machine Tool Company, the editor said of the architect's drawing reproduced as the initial illustration: "The view, Fig. 1, gives a very good idea of the appearance of the shop as it is approached from the city, although owing to the fact that a good photograph could not be obtained from this point, the engraving has been made from an artist's drawing which, after the manner of artists, is somewhat idealized. In place of the fountain that appears in this view, there is a flight of steps which appears almost as well and is more useful, and the people seen walking in the street in front of the shop are not really made of wood, they only appear so, as in fact they always do in architect's drawings."

'Safety First'—at Last

Fred Miller, writing from France, said that as many as 60 workmen were injured in a day, a large proportion of them fatally, in erecting and operating the Exposition. There seems in the United States, however, to have been the first faint glimmerings of a working safety movement—both for reduced lost working time and for greater worker comfort.

May 10 *AM* showed one of the earliest examples of a dust suction arrangement for a dry-grinding room. The description began with editorial comment about the dangers of having men working in a dusty atmosphere and compared this condition with the fact that the men were allowed to work all day in such an atmosphere without any protection whatsoever.

Again, Aug. 9: "In a bookbindery in Philadelphia a few days ago a man working about a folding machine had a couple of his fingers caught in the gears, stopping the machine and holding him secure and helpless. A fellow workman came and released him, and in the operation got his own fingers caught in the same way. The men later each had two fingers amputated at the hospital." Probably the origin of the old yarn, "Whoops there goes another one!"

Here is another early safety item published Aug. 1: "**Don't wear celluloid collars. A motorman the other day was tinkering with the motor apparatus and his collar was fired and he was severely burned.** Around a foundry, a blacksmith shop, or even a machine shop, it would not be unlikely that celluloid might be sometime ignited and it is much safer not to incur the risk." That's putting it mildly; "hot under the collar" is ordinary beside hazards like this.

Said the editor of *American Machinist* Feb. 1, in an editorial entitled "The Disappearance of Hand Work"—"We think of and adopt the means that we have and the old chipper and filer is not among them . . . Machine work upon the whole is vastly cheaper and vastly more accurate and reliable than the handwork that it has displaced. There was not long ago, if there is not now, one little place about the main bearing of a straight-line engine which it was the practice of the shop to chip and file, and the mechanical critics were inquiring why this little bit of surface was not milled or planed as it naturally should have been, instead of being done in the old-fashioned way. Professor Sweet has been in the habit of confessing that the old practice was retained to give the boys the one solitary lesson of the shop in the obsolete art of chipping and filing. It is easy to sympathize with the sentiment exhibited, just as we stop in the zoo before the solitary buffaloes that are trying to keep alive, but time sweeps clean at last." I suspect that Editor Fred Miller would be somewhat startled were he to see the current figures on production and sale of chisels and files.

Said an English correspondent, "The old system of learning a trade is probably gone forever. And the evolution of a sufficiently satisfactory new system can only be effected by trial-and-error. In the meantime Americans should certainly push business over here, as there is an undoubted desire to give all possible outside work to Americans rather than to foreigners."

The calamity criers needn't have

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worried—about ingenuity, at least. *American Machinist* for March 15, 1900, describes a job of replacing iron elements on a rebuilt mine "wagon" at a remote mine. Sections were made from discarded wagon tire cold-chiseled to length, but no equipment was available for drilling holes until one of the men realized it could be done by marking them and shooting in 30-cal. holes with a Spanish-American war model Winchester rifle . . . If that isn't Yankee ingenuity, what could be?

Those who recall our blast of early last year against abandonment of college shop courses may smile to know the argument went on 50 years ago as well. *American Machinist*, in backing Prof. Higgins in his belief that mechanical engineers should have shop training, blasted Prof. Thurston for advocating "shop tinkering" in referring to shop work as a "gymnastic exercise of great value." Prof. Higgins advocated a school in which "each boy having a taste or inclination for machinery shall commence on a common level with others having similar tastes or inclinations, and each go as far as his individual capacity or opportunity will permit in both real shop and book knowledge."

Readers who have noticed the recent article entitled "Where Are the Toolmakers?" (*AM*, Nov. 17) will be interested in this quotation from a reader's letter of March 15, **"Where is the old-fashioned all-around machinist that in these days goes by the name of toolmaker coming from? . . . The toolmaker is growing scarce . . . the apprentice system is going and no matter how anxious a boy may be to learn his trade, his chance of becoming more than a mere machine operator is growing less each year."**

The Toolroom Was Born

DEVELOPMENT of the toolroom as a separate and specialized department of the plant apparently began during 1900. Detailing what such a room should include (May 24), the editors said: "The workmen should be smart men who would take a deep interest in the work. An intelligent clerk with a boy to assist him would also be required . . . all flat drills must be kept up to size. Sets of turning and planing tools made out of sections of steel suitable for the lathes and machines should be kept in the stores, always ground and ready for work. These to be supplied to the workmen and returned to the stores when the cutting edge is gone, and others given out. A laborer should be employed to act as tool carrier and go around to all the machines collecting tools for repairs and regrinding. A sample of each kind of tool in use should be kept in the toolroom. These samples or patterns could be sent to the smith so that he might forge new tools and repair the old ones correctly."

In discussion, one gentleman thought the system in the toolroom might be carried too far. Another felt that it was not applicable in any but large plants. Another rather daring discusser suggested that not only was a toolroom necessary, but it might be advisable to have a gage room as well and he even advocated the use of toolholders instead of solid tools.

Paris Had the World's Fair

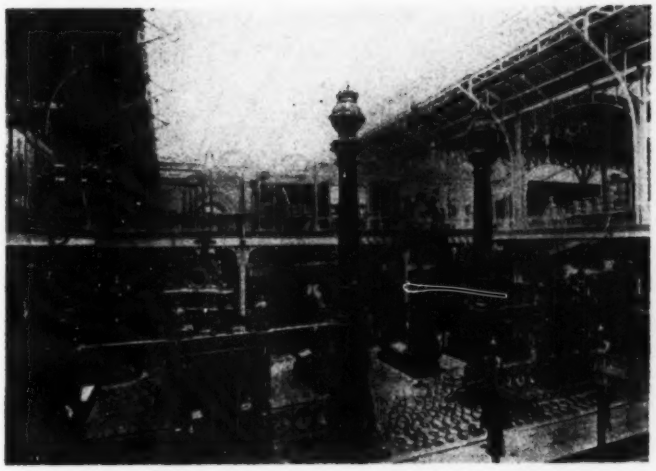
"A great electric firm of Berlin has been awarded 12 grand prizes, 11 gold, 21 silver and 7 bronze medals—all of which it will have to pay for before delivery."

Thus did Editor Fred Miller report the snowstorm of prizes that accompanied the great Paris Exposition of 1900. American exhibitors were more numerous than those of any other country, and they collected more than a thousand grand prizes and gold medals, plus so many lesser awards that the editors couldn't find space even to list the recipients.

In thinking about succeeding paragraphs, it must be remembered that Russia had just begun development of a machinery industry in Siberia, with Chinese to help. New Zealand was starting a metalworking industry too, importing half of its small tools and about

30% of its machine tools from the U. S., with the percentages of both rising. Outside England, the United States and Western Europe, "metalworking" still meant hand work.

Because the U. S. Government was dilatory in applying for space at the Paris Exposition, potential exhibitors found their allotments too small. One New England machine-tool builder found, for example, that he had been alloted 2 x 3½ ft—too small for any machine he made. He was finally granted 4 x 7 ft, enough to show one small lathe and a sign directing visitors to his more extensive exhibit at Vincennes. This latter building, 125 x 350 ft, was built 4½ miles from the main Exposition, near the railroad displays, so tool builders could provide adequate exhibits. Steam cars and horse cabs ferried visitors from main Exposition to this specialized show. Fred Miller pointed out, however, that exhibitors of air tools and exhibitors of machine tools were side by side at Vincennes, with the result that possible customers were unable to talk with the machine-tool exhibitors. Warner and Swasey had a similar problem in their space at the main exhibit. **"An exhibitor of phonographs across a narrow aisle puts a six-foot brass horn onto one of his 40-mule power phonographs, turns the horn towards the astronomical instruments exhibited by Warner & Swasey and "cuts her loose" on the latest variety show song which, after a hundred or so repetitions, becomes with its brass accent simply maddening."**

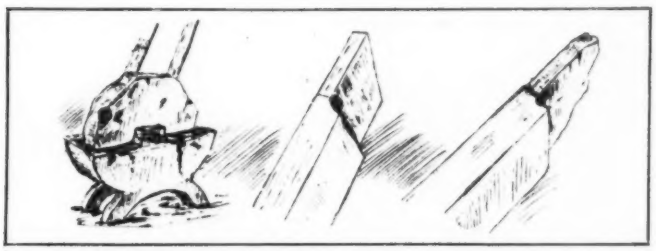


Embroidery—in wrought iron—in the exhibit of the Swedish Iron & Steel Company at the Paris Exposition. The editor called these "beautiful effects produced by the combinations of finished and black surfaces and, in some cases, by utilizing the colors of oxidation produced by heat; commonly known as 'temper colors' "

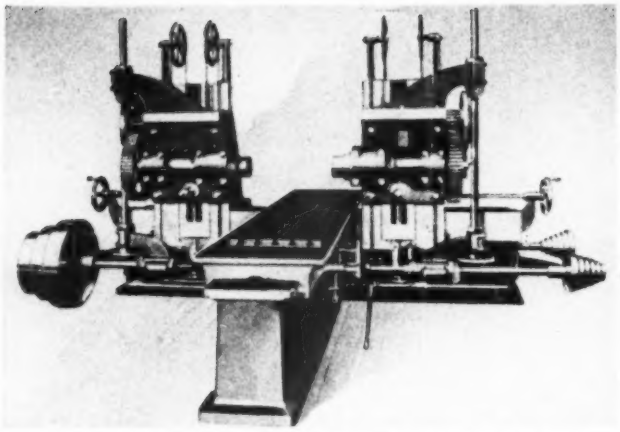
Discussing machine tools at the Paris Exposition, the *Cologne Gazette* remarked: "Of all exhibits, the American are the most interesting. They are full of lessons, from which all Europe can learn and profit. Less than forty years have elapsed since the Americans imported all their machine tools from England. Today the reverse is the case. This fact is explained in the first place through general circumstances in which all countries of Europe, with the possible exception of Russia, differ from the North American continent. In Europe, raw materials are expensive, but wages low. In the United States, raw materials are cheap, but wages are high. The high wages, however, have to a certain extent brought about the cheapness of raw materials . . . In Europe, on account of the scarcity of raw materials, there prevails a general parsimony. This fact explains in the first place the manifold chemical and metallurgical inventions which are constantly being made on this side of the Atlantic. In the United States, however, efforts are made in almost every direction to save labor. Hence the variety of machine tools.

"The European who makes a trip through the United States, when he returns to Europe declares again and again that the United States is a country of wastefulness, as far as raw materials are concerned. The American, on the other hand, who comes to Europe, never fails to declare that Europe is 'a slow country,' because we make, for instance, our boots and shoes by hand . . . "

The Gazette gave high praise to Brown & Sharpe measuring instruments and Pratt & Whitney lathes and drilling machines, comparing them with the best in Europe. It also points out that in 1899 Germany took more than 40% of our



In arguing for a toolroom, these sketches were presented, with these captions: Under the grindstone, "A special tool grinder sometimes seen in old-established works." Under the tool at center, "What the gentleman at the toolroom window will give you." Under the ragged tool, "What you find when you have to look around the shop for it." Here is a very early example of cartooning in a technical magazine



Pratt & Whitney showed this double-spindle miller as part of the "most complete installation of tools" at the Paris Fair. It was designed to cut both sides and the top of a lathe bed at once. Note the number of step pulleys

total machine-tool exports, a matter of some $2,638,403.

Bethlehem Steel Company exhibited a large lathe taking a 3/16-in. deep cut with 1/16-in. feed on mild steel, at a rate of 120 fpm, at least six times as fast as the ordinary tool at that time would stand. Said Mr. Miller, "It is easy to see that if there are no disadvantages to offset this, it means very much to machine shops; much increased capacity of all machine tools, especially heavy ones, and such changes in the design as will enable the increased driving power to be applied to them." To indicate the relative conditions of the transport of France and the United States, Mr. Miller reported that the Bethlehem lathe was shipped on three flat cars from Bethlehem to New York in one night, while it took ten French flat cars to carry it to Paris in eight days, the two rail journeys being approximately equal in length.

'Automobilism' Becomes An Industry

Attired in goggles and linen dusters, more affluent Americans were tearing around in that new plaything, the automobile. A Locomobile cost $600, New York had electric cabs and hansoms, and its first Auto Show in Madison Square Garden. **A third of the cars at the show were electrics, most of the rest steam; gasoline-engine automobiles were still as scarce as steering wheels, and gasoline, untaxed, was ten cents a gallon.** But the auto industry was already clustering in the Midwest, with Cadillac ($750 plus $100 for a tonneau), Winton and Olds ($650) in Detroit, Haynes-Apperson in Kokomo, Ind. For example, this note May 17: "Three new automobile manufacturers are asking for machinery at Chicago. They all propose to manufacture vehicles propelled by gasoline power . . . The Pratt & Whitney Co. has sold an equipment of 27 tools aggregating about $8,000 in value to the prospective manufacturer of a specialty in this city (Chicago)." That's $300 a machine—without motor, of course.

As you'd expect, *American Machinist* was full of references to the new horseless carriage—it was the thing to discuss at the moment. Said Tecumseh Swift: "It is more of a luxury than anything else now and it may not get far beyond that for a long time, but it will later become a popular convenience and then a universal necessity of modern civilization. The other day a lady of wealth with a party of friends visited the New York Navy Yard and they were conveyed in five automobiles. We hear of many automobile theater parties and other similar employments of the revolutionary vehicle. These parties usually make use of the automobile cabs, but besides these, private vehicles are becoming numerous . . . the other evening I saw a race between a bicycle and a motor carriage, both going much faster than regulation speed . . .

"A lighter motor than it is now possible to produce could scarcely be asked for, and economy of fuel for the power developed is also satisfactory. Vehicles employing different types of motors may develop side by side, with special advantages for each . . . We want perhaps least of all a racing machine. Speed records will never establish permanently any type of machine because we will seldom be able to use them at high speeds and will less frequently want to. The typical horse which has been such a value to help man is not the race horse. Neither is the making of long runs over rough roads the single aim to be kept in sight in designing the vehicle."

"Get a Horse"

There was early appreciation of the commercial potential of the "autocar" or auto-carriage, even though M. C. Krarup said flatly Jan. 25: "There is not yet a single automobile in the United States which is thoroughly adapted to supplant horse traction for all classes of users in any one field, let alone all fields of vehicle work."

Arthur Herschman described May 24 a steam-propelled vehicle designed by him and built for the Adams Express Co. Said the editors, "The writer thoroughly believes in the automobile. He said that if the motor wagon is given an unobstructive field and fair play it will hold its own and oust the horse truck in short order."

In November 15 *AM* said, "One of the latest things in the machinery line is an auto-mowing machine; i.e., an internal-combustion-engine-driven mowing machine. The McCormack and the Deering Companies of Chicago both exhibited them at Paris. "Engineering" of London, in describing one of them, closes by saying, "Whether a petrol engine in a wheat field will be welcome to farmers remains

to be seen." See? In the United States, caterpillar treads were already being applied to reapers and mowers powered by steam.

M. C. Krarup, discussing the problems of designing automobiles for mass production (Jan. 4), says flatly: "Not one but several dozens of automobile types of vehicles presenting essential variations must be evolved before the horse may be considered as successfully supplanted in its principal fields of work." He points out again and again that the necessity of placing the driving mechanism in the vehicle makes the weight of the automobile prohibitive and that the design of the car is so rigid that it cannot stand the rough roads. Apparently Mr. Krarup anticipated no improvement in then existing road surfaces because he says flatly, "It is quite within the range of possibilities that a French vehicle may be a success in France at a weight of 3,000 lb., and a vehicle built on the same general plan may be an absolute failure in the United States even at a lower weight."

The Tire Problem

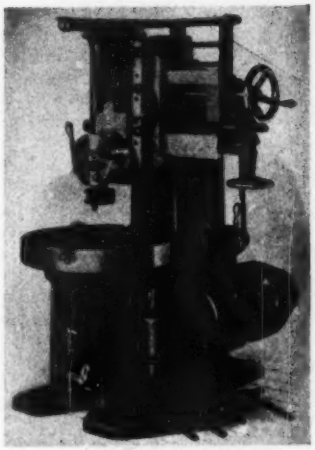
He says further: "No pneumatic tire has yet been invented, the material of which will endure the strains of, for example, serving to stop suddenly by ground friction, a heavy automobile on a downgrade curve. The use of rubber for tires of a heavy vehicle is purely in the experimental stage, so far as economical usefulness to the automobile owner is concerned.

Again he said, "The most rational method so far devised for obviating twisting strains on motor and gear parts, and at the same time perhaps economizing weights somewhat, consists in hanging the motor on the frame of the vehicle rigidly connected with the rear axle . . . There is nothing to hinder the employment of special springs for the support of the motor in this position, and the method would undoubtedly be adopted by all designers of heavy automobile vehicles were it not for the intolerable inconveniences that accompany it, and the general unsightliness of the construction. Among the inconvenieces it may be mentioned that the design compels slight repairs and adjustment of motor parts to be made by the operator lying flat on his back reaching upward and likely to receive scalds from hot lubricating oil dropping onto his face. This laughable spectacle, however, is often witnessed in Europe where this design has been in considerable favor, probably chiefly with a view to the increased carrying capacity of the vehicle."

Discussing rear driving of automobiles (not the back seat variety), Mr. Krarup says, "The internal explosion engine when employed for traction purposes requires a number of flexible connections between the power and the work, and the design which includes rear driving minimizes the chances for obtaining these flexible connections, throwing nearly all the burden of this requirement upon the rear tires while at the same time rendering the practicability of these tires very questionable by loading them down with greater weight than they have been proved able to sustain." (This will also serve as our current entry in the International Non-stop Sentence Derby.)

Charles E. Duryea of Reading, Pa., who will be recalled as one of the first developers of the automobile, defended rear-wheel driving and front-wheel steering, which the previous author had derided. Said Mr. Duryea: "Duryea vehicles have been built for the last three years for two and four people, carrying without passengers less than 200 lb. on the front tires. They have been driven up grades as steep as 25% through snow up to their bodies, through stiff mud as deep as 10 inches, and although it has been possible to jerk the front wheels off the ground by the sudden application of power, there has never been sufficient momentum in the flywheel to overcome the inertia of the body and passengers and cause an upset." In other words, no somersaults when you drive a Duryea.

Two more items serve to forecast our present automotive world. For example, in Sept. 6: "One of the most serious automobile accidents yet reported occurred at Pittsburgh, Pa., on August 18. The vehicle was owned by a lawyer of Pittsburgh and he had as a companion an official of the Carnegie Company. The vehicle was steam-propelled, the steam being generated by the combustion of gasoline. First the driver lost control of the motor or steering apparatus and the vehicle upset. This was followed immediately by the explosion of the gasoline tank. The machine was thrown up in the air and the driver was thrown out, striking on his head. The other rider was entangled in the machine and fell back and was severely burned while unable to move. The gasoline tank is said to have carried a pressure of 30 lb. and the steam boiler 20 lb. The carriage was so wrecked that it cannot be repaired." They should see our metropolitan newspapers any Monday morning.



This smaller Warner & Swasey boring mill was new at Paris, incorporating a separate table drive, covered gearing, and a friction clutch by which the number of table speeds was doubled

In the issue of Oct. 18 was described a visit made by a young gentleman upon a young lady just outside Columbus, Ohio. The trip was made by electromobile taxi. As the car approached its destination the "manipulator" (chauffeur) discovered that "disarrangement of the brake" would prevent his stopping the machine. "After several trips around the block, the

young man got the young lady to come out of her home and to the roadside. He explained as best he could as the automobile flew past, and after a half dozen more turns she began to understand." The battery had two hours more to run and if it ran out in the vicinity of her home the young man would never be able to get back into Columbus. So on a railroad station mail-catcher plan, her intended visitor passed out the book, then the candy and finally the roses to the young lady. "This, with a few more round trips to say good-bye and a warning from the chauffeur that there was just enough electric power left to get back into town ended their engagement."

You must remember that the cars those days made as much as 10 mph and that the first 1000-mile trip had just been made.

Machinery Was Good, Machining Inefficient

"It would be difficult to find a machine part produced by any commercial firm that would equal this (the receiver of the Krag-Jorgensen rifle) in its unique and difficult operations of manufacture. It comes from the drop forge in a solid mass of steel weighing 6½ lb, and the 121 separate operations on lathe, milling machine and profiler that it passes through reduce its finished weight to 1.4 lb."—From a story on Springfield Armory, April 5.

Standard machine tools of 50 years ago in many cases looked much like their modern counterparts, except for refinement of detail, simplification of controls and addition of guards. The differences are largely in the less-visible things like feeds, speeds, flexibility, strength, and rigidity.

The initial quotation gives some idea of the amount of machining made necessary by lack of today's forging, casting and forming techniques, but machining itself was slow and inaccurate. Describing a rifle-barrel drilling machine at Springfield Armory, the editors say: "The bore, 0.3 in. in diameter, 30 in. long, is drilled in an average time of 1¼ hours, the barrel turning at a rate of 1,200 to 1,250 turns per min. We thus see that the feed of the drill is about 1/3 of a thousandth of an inch per rotation."

Again, "Asked what allowance for variation was made in this gaging, Mr. Ladd replied that there was none whatever, but that readers know that the Springfield Armory has exerted a commanding influence upon the development of interchangeable manufacture and the practice of today is fully up to the highest standard—on the receiver alone there are 121 distinct operations, all of which have to be made with great care so that every receiver shall be practically the exact duplicate of every other one in every respect . . . " It took World War II to attain tenth tolerances and to achieve real interchangeability.

While ideal grinding speed, then as now, appears to have been a mile a minute (5280 sfpm), planers cut at 22 (small) to 17 fpm (large) and returned at the same speed, compared with our present top of 310 fpm cutting and higher on the return, lathes turned at 200 fpm, compared with today's top of 1500 to 1600 fpm. One reader advocated general adoption of the speed achieved by Cincinnati Milling of 36 fpm cutting and 50 fpm returning on planers—a radical improvement of almost 100%. But it must be remembered that, in 1900, Mushet tool steel had been used only five or six years, so carbon steel was the common standard. Carbides and Stellite were a quarter century away.

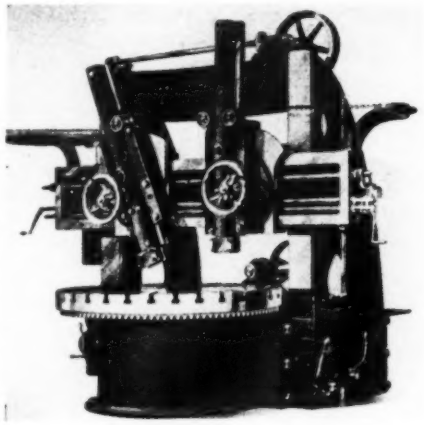
An early "straight line" planer, made by L. W. Pond Machine Company, was described Nov. 22. It was so called because for the first time it replaced the usual curves and curlicues with straightline functional design. It was of course equipped with belt-shifter drive.

July 5 *AM* showed the first pictures of new Brown and Sharpe plain grinding machines developed for manufacturing grinding as distinguished from universal grinding for which machines had been available for about 30 years.

Bickford Drill & Tool Co., Cincinnati, built a four-spindle drill for Westinghouse capable of drilling four, 3-in. holes simultaneously through 12 in. of solid steel with a feed of 1 in. per min. The machine was different than previous models of the same company in that each head was separately adjustable for feed and could be separately started and stopped.

Garvin Machine Co. in offering its new model milling machine said, "It will interest persons of taste as it has a simple elegance which is a delight to the eye. It will also interest the machinist on account of its accuracy, convenience and ease of operation."

Landis Tool Co. headed its ad for Feb. 1, "One Man Does the Work of Four," goes on to explain that its new plain grinder accomplishes the same work as four men



This 62-in. Bullard mill was exhibited at Paris (Vincennes), tooled to turn interior surfaces of carwheel tires. **The old** French machine did two per day; this machine did four the first hour. But Payson Bullard retooled to produce six per hour, saying: "If a competitor is after this order and proposes to show what time he can turn these tires in, I propose to give him something to do"

could previously perform on lathes.

Feb. 8 *AM* showed a cutting-off saw with a circular instead of a reciprocating motion and utilizing a blade which was reportedly "so hard that they must be sharpened by grinding." The machine had a throw-down overarm which carried the blade, no guard, and could be driven either by belt through a conventional pulley or by hand through a crank. (As a matter of fact, guards were a rare thing in those days; every operator took a sporting chance every day.)

A hacksaw made by Wright & Colton Wire Cloth Co., described Sept. 20, had vertical instead of horizontal movement of the saw with fast return stroke and positive rather than gravity feed.

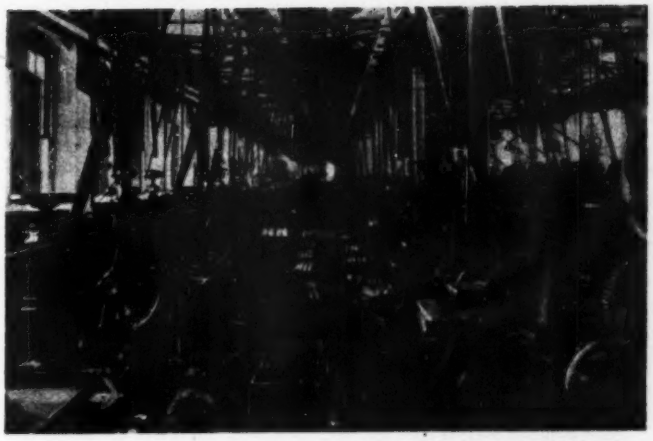
In the issue of May 3 the editors asked the names of parties making machinery for "automatically making small castings such as gears, dials, etc., from aluminum or other alloys." Die casting was still a mystery then—as was surface broaching and other modern finishing methods.

Said Charles N. Cady in advertising his drill grinder, **"Get the boys a good wet grinder and put the grind stone on the retired list. Then you will get better work and more of it at less cost, and a vote of thanks from the boys."** Less an ad than a political appeal.

In May 3 a geometric boring tool was described in detail. This is apparently one of the earliest descriptions of a setup for drilling square and polygonal holes. It was invented by A. K. Phillips of St. Louis.

July 5 *AM* described a "novel" milling cutter seen in England. The novelty was inserted teeth or "separate cutting blades," which the editors thought "might be valuable for cutters of large size."

Remember the consistent interest in how steel wool is made? Apparently it is nothing new, for *American Machinist* described in 1897 a machine for making steel wool which operated by passing a single cutting tool over a series of thin steel washers mounted under compression on a mandrel. In 1900, *AM* showed an improved machine in which a single-point tool cut endwise along a tightly wound roll of thin sheet steel. The latter machine was actually used commercially for cutting sheet zinc into shavings for the cyanide process of gold extraction.



This forest of belts rose in the milling shop of the Hill Shops, Springfield Armory, in 1900. This shop produced parts that were "practically exact duplicates of every other one in every respect." Said the editor: "It will be noticed that in these pictures things look very neat and orderly. Work was not being done at the time the pictures were taken, but when it is going on the appearance of the shops is scarcely different. It is the regular practice to scrub all the floors once a week." Evidently good housekeeping was beginning to be appreciated

"Liquid-Operated Machine Tools"

H. A. Coombs discusses (Feb. 1 *AM*) an earlier letter by Tecumseh Swift about "liquid-operated machine tools." Mr. Swift had apparently suggested the advantages of using liquid pressure to operate moving parts of a planer. Mr. Coombs agrees on this application but says flatly: "None of the moving parts of an engine lathe suggest to the observer the practicability of using a liquid under pressure to operate them."

Aparently the first hydraulically operated planer was patented in England in 1868. Mr. Coombs goes on to discuss a series of patents in the preceding 30 years and points out that there is no arrangement in any for varying speed according to the work being done. Nor is the feed operated by the same means as the table.

First patent for a hydraulically operated turret lathe was granted to C. M. Conradson of Madison, Wis., in January, 1893, and a later patent for a turret lathe to James Harkness in October, 1899. The latter actually incorporated a hydraulic turbine and included operation of the workholder at right angles to the reciprocation of the turret. The headstock spindle was belt-driven, however. One of Mr. Coombs' conclusions is: **"Whether the hydraulic lathe will come into general use it is perhaps too early to say, but it does not seem as though the advantages of the hydraulically operated planer were real enough to make it a dangerous rival of the time-honored rack-and- pinion variety, although one was invented more than 30 years ago."**

Mr. Coombs comments recall the cartoon "Born 30 Years Too Soon."

Several readers mentioned defects in machine tools. One pointed out that the taper hole in the tool bar of a boring mill was seldom central with the faceplate, making it a difficult matter to fit boring bars in which to use double-end cutters. He further says that **"Countershaft and pulleys are seldom anywhere near adequate for the loads and are not only self-**

Bucolic Bliss

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A reader commented July 5 that machine-tool builders should guarantee a cutting efficiency for their machines. He thought a speed of 20 fpm would be about right on a standard lathe. He also felt that feed handles should be standardized among makers, quoting as his example the case of a transport about to start for the Boer War. A bolt broke and was ordered in London on a rush basis. When the shift ended, the lathe operator simply shut down. The man on the next shift found the lathe had been stopped in the middle of the finishing cut and that the tool was cutting a taper. But he didn't know which way to turn the crossfeed handle, so gave it up as a bad job and went home too.

The reader also insisted that cut lathe gears were better than cast ones, that feed changes should be made by lever rather than by gear change, that chuck and feed screws should have threads of the same hand, that saddles were too high and designed to spill the "water" coolant onto the operator, that "water" cans should be replaced by coolant systems, that rests and box chucks (on hollow-spindle lathes) were too big and clumsy (tiring the light but fast worker), that spindle noses and center tapers should be standardized.

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We Are Still Wondering

SAID *American Machinist* for Sept. 6, "Vice-Consul Reed at Madrid has informed the State Department that by a decree, time in Spain is hereafter to be counted from 1 to 24 hours, the order to go into effect January 1, 1901. The day is to begin at midnight. Interval between midnight and 1 o'clock will be designated by a cipher and the number of minutes as 0.05, 0.59." Said *American Machinist*, "The new method is better and we wonder how long it will be before our progressive American spirit will lead to its adoption here."

issue thereafter reported price advances in shop tools and accessories, most of them about 5%.

The Commercial Review for April 5 indicates that everybody was busy. The Frick Company was reported to be "struggling along against such odds as did the small boy at the school picnic who couldn't eat any more, and had already filled all his pockets." Said the item, "Further, the shop is overfull of work and every effort is being bent to catch up. Like most every other machinery manufacturer in the country the Frick Co. is suffering from nervous prosperity and to judge by the number of orders still on its books it is likely to do so for some time to come, in spite of overtime work from president down."

Landis Tool Co. was reported as follows: "The spacious extension recently added to the shop is now occupied and almost fully equipped, enabling the company the better to cope with the numerous orders daily received." Daily?

Chambersburg Engineering Co. was said "to present no deviation to the prevailing rule of rush. Not less than 40 steam hammers from 250 to 8,000 lb. are under way in the shops."

A reader protests against the methods in use in 1900 in selling second-hand machine tools. He recounts going to a sale which was supposed to open at 10 and did not begin until 11:15. **There he saw a Brown & Sharpe milling machine that had been in use some 15 years or less. The price was $400 as it stood. A 16-in. Prentice lathe and a Brown & Sharpe tool grinder were priced at $200 and $135.** All the tools were sold at these very high prices, and the reader points out that it was the first time that he had ever seen machine tools sell themselves.

According to July 26 *AM*, in 1890 Cincinnati had only five or six machine-tool factories. In 1899 the number had risen to 25 and by 1900 to 29. In 1899 the 25 plants had a capital of $1,805,000 and an annual output of $3,340,000 with 2,798 "hands". The four new firms added in 1900 had a combined capital of $175,000. In 1898, 50% of their production was exported.

"Indications are that the shop formerly occupied by the Wheel and Cycle Bar Co. at Wallingford, Conn., will be used as a spoon factory by G. M. Hellenbeck, formerly of the Hall-Elton Co." Forecasting the decline of bicycle sales?

J. W. Duntley, president, Chicago Pneumatic Tool Company, had a tête-a-tête with Kaiser Wilhelm in June, during which the latter operated a pneumatic tool. Said the Kaiser, **"Now I'll go and get some lunch, then come back and use the tool some more. It's good for the digestion."** In those days, testimonials came from royalty, no less.

Ex-Consul George F. Parker, writing in April *Atlantic Monthly*, said: "The editor of the *American Machinist* made a business tour of Europe and wrote for his paper a series of articles on the use and prospects of American machinery abroad. They were written with a perfect knowledge of the business itself as well as of what needed to be told . . . When his tour was finished he had told the best that was known, said the last word so far as he had gone, and given more real information within a few weeks than all the consular corps of the United States could possibly have gathered in years."

Oil Stock Swindling—Small Scale

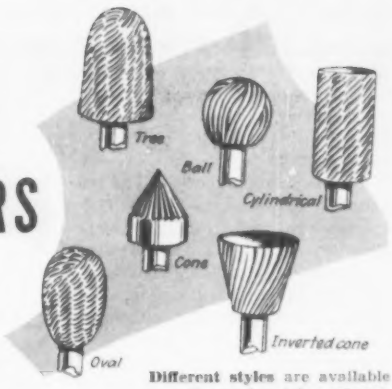
An aggressive campaign was carried on by *American Machinist* for years against swindlers. One of the pet rackets was selling various kinds of oil to the unsuspecting. One, for example, wrote a "personal" letter to companies on its sucker list, saying that several barrels of oil had been shipped to the immediate vicinity of the person to whom the letter was addressed, and that the shipper had discovered later that the consignee had unsatisfactory financial standing—so he was reoffering the oil for sale at a bargain.

American Machinist published the names of the companies indulging in such practices and was thereupon threatened with a suit for libel. At this point the editors detailed the business methods of the firm threatening suit, which included the fact that the letters received by a number of potential customers were identical, reproduced by some wholesale process and that signatures were likewise produced mechanically. The editors pointed out that either the company was making a practice of shipping oil to irresponsible parties all over the country, or the oil wasn't being shipped in the first place, and indicated that the latter might be true by producing statements from various freight agents that no such shipments of oil had ever been received. The final paragraph is interesting. It is "We await the impending suit and in the meantime *American Machinist* will appear weekly as usual."

Verb. Sap.

"DON'T let the sometimes florid rhetoric which characterized the end of the 19th Century mislead us. Revolvers still were standard equipment in many editorial offices. Not only the firearms, but even the most casual editorial comment, was loaded. Editors took refuge behind rhetoric for the same reason that they sometimes found the early telephone poles convenient — to seek shelter behind when those who objected to their views or news came after their hides."—*Wallace F. Bennett, speaking before the Newcomen Society in New York, Jan. 21, 1949.*

How to Choose and Use ROTARY FILES AND BURS



Different styles are available to suit varying job contours. Some of the more common are shown here, but there are many others, including concave forms

Hours of hand labor can be saved by the use of power-driven rotary files and burs, but is is important to select the right style and speed for the job.

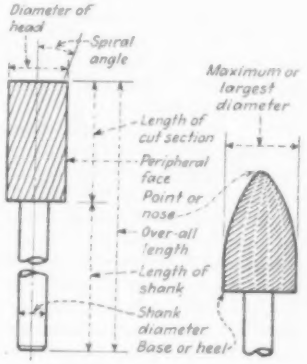
BY E. BLAIR LE FEVRE
Mechanical Engineer
NICHOLSON FILE CO.

ROTARY power filing is an excellent method of abrading or smoothing metal and other materials such as plastics and wood, particularly on jobs where hand files are impractical. Hand-cut rotary files or ground-from-solid burs are the two principal types. The latter type, however, may be either high speed steel or cemented carbide, as required.

Both rotary files and ground burs are widely used for chamfering corners, forming fillets, removing burs and fins; and for elongating holes and slots, particularly in hard-to-get-at places. Both are available in a variety of shapes and sizes for almost any conceivable application; ball shape for fillets, tree or flame shapes with blunt or tapered points, and oval shapes, for forming a variety of other work, cone and inverted cones for chamfering, and cylindrical shapes for slotting, beveling, etc. There are a number of other shapes for more specific applications, but any style is capable of countless jobs from working aluminum and magnesium, making dies and molds for plastics and die castings, to balancing cast-iron pulleys.

Anatomy of the Tools

The "business end" is the head or cut section. Head shapes and sizes, in addition to cylindrical, tree shape, ball and inverted cone, include types having concave contours or filing surfaces. "Length" refers to the head or cut section. The tip end is referred to as the "point" or "nose," depending on whether it is pointed or rounded. The opposite end of the head is called the "base" or "heel." The shank extends from this point. One-piece, or integral, design is usual when the head is smaller, the same diameter or slightly larger than the shank. Otherwise, the shanks are screwed into, or in the case of carbides, brazed to, the head. Teeth or flutes are provided in three degrees of cutting action; i.e., coarse, medium and fine, usually designated on the shank as C, M or F respectively, along with other numbers designating the specific tool. The choice of cut should take into consideration the material to be filed, the relative amount of stock removal and the finish desired. The two major lines are designated by shank size, as the ¼-in. shank and ⅛-in. shank. Other sizes are special.



Correct designation of the various parts is important, and use of the proper terms will prevent confusion when ordering tools

Hand Cut or Ground from Solid

Hand-cut rotary files, principally because of the intricate shapes involved, are cut a tooth at a time by an expert hand cutter with hammer and chisel. Although he may have a blueprint to guide him for the number of teeth per in. and other information, the hand cutter depends upon his ability to hold the chisel at just the correct angle and to strike a blow of just the right force to form efficient cutting teeth of regular height.

Because hand-cut teeth are broken up they seem to dissipate the heat created by friction. Therefore, they are recommended for tough die steels, forgings, welds, or any scaly, tough, dense material that is hard to cut.

Ground burs are cut with a series of unbroken flutes. In one maker's product, basic flutes extend the length of the cutting head, from the base to the nose; and intermediate flutes are cut into these at appropriate places. This results in efficient cutting action and lends

itself to resharpening. The over-all efficiency of some burs—particularly the carbides—is better, however, when the flutes are indexed; i.e., all running to the point as a common center.

While a freehand method of grinding flutes is quite common, the modern method calls for precision machine grinding, which insures accuracy of shape and even tooth height around the periphery, eliminating jumping, vibration and non-uniform wear. Each bur is cut on a machine actuated by a master bur, guaranteeing uniformity of burs of the same type and size, no matter how many are produced in a lot.

In general, ground burs are more efficient than hand-cut rotary files on nonferrous metals, because their ground teeth free themselves more readily of chips.

Of course, ground burs may be resharpened when they become dull and inefficient, normally about twice, depending on the usage they have had. Rotary files do not lend themselves practically to reconditioning, but can be converted to a bur of similar type and size at relatively small cost. Both jobs can best be done by the manufacturer of the tools.

An accompanying table gives a comparison between the cost of using hand-cut rotary files and ground-from-solid burs. Cost will vary with the shape, cut and condition of the tool.

Tips on Using Files and Burs

Rotary files and ground burs can be used in drillpresses, lathes and electrically or air-operated hand or flexible-shaft equipment. There is little difference in the efficiency of files or burs in electric tools as compared to air tools, provided the speeds have been reasonably well selected according to size.

Comparative Costs of Ground Burs and Hand-Cut Files

GROUND BUR	
Initial cost	$1.90
First resharpening	.38
Second resharpening	.38
	$2.66
HAND CUT	
Initial cost	$1.50
Reconversion to ground bur	.50
Resharpening	.38
	$2.38

Rotary files are precision cut by hand with small chisels. They are recommended for use on scaly, tough, dense materials

The following principles should help the user toward best results:

(1) Move the file or bur at an even rate and pressure to avoid the hills and dales which will show up if unsteady pressure is applied.

(2) Proper speeds are important. The speed at which the bur can be driven depends to a great extent on the size of the bur. The smaller the bur, the faster the speed.

(3) Be sure to use sharp files or burs. Never overlook the fact that the operator's time is the big cost item and he needs well sharpened tools if he is to attain maximum production.

(4) Use as short a grip as possible on the shank for accurate control and a longer grip for reaching the out-of-the-way places only when necessary. Although standard-length shanks will do the majority of jobs, other lengths can be obtained for special cases. Also, for ¼-in. files and burs having a shoulder at the heel, extensions can be procured.

(5) Normally, medium-cut files or burs will give sufficient stock removal and acceptable finish to meet most needs. However, if heavier cutting or greater stock removal is required, coarse-cut should be used and, correspondingly, fine-cut should be selected if a very smooth finish is required.

How About Speeds?

It is difficult to give absolutely correct recommendations because the speed is bound to vary with the skill and technique of the operator, the type of power being used, the material being removed or finished, and the type of operation. A certain amount of flexibility is obtained in that higher speeds than normal tend toward a better finish, but less stock removal; while slower-than-normal speeds give greater stock removal, but generally poorer finish.

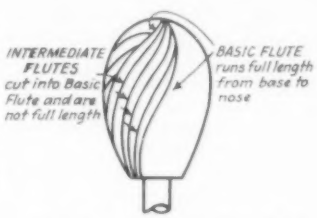
Accompanying tables are given in rpm rather than in sfpm because the former are more conveniently used. While sfpm are the basis for speed calculation, coarseness of teeth per in. is also a factor. Thus, the fine cuts should be run somewhat slower, the coarse cuts faster than the table shows.

Undoubtedly many instances can be cited in which burs have been used successfully at speeds much higher than those in the table. The best way is to determine what speeds will give most satisfactory results on a particular job, using the tables as a starting point.

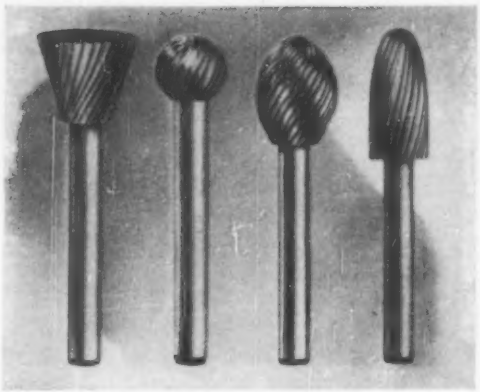
Function of Carbide Burs

The cemented-carbide bur is one of the most recent developments. It has tremendous possibilities for reducing burring costs in its particular applications, foremost of which is likely to be found on long production runs.

For example, it has been demon-



Ground burs have unbroken flutes. Each basic flute with its intersecting intermediate flutes is designated as a section. Other types have all flutes running to a common point



Typical ground-from-solid burs, showing the precision ground teeth resembling those of a milling cutter. Heads are screwed on the shanks

Approximate Speeds of Rotary Files and Burs for General Applications

Dia. in.	SPEEDS FOR MEDIUM CUT				
	Mild Steel rpm	Cast Iron rpm	Bronze rpm	Aluminum rpm	Magnesium rpm
1/8	4600	7000	15000	20000	30000
1/4	3450	5250	11250	15000	22500
3/8	2750	4200	9000	12000	18000
1/2	2300	3500	7500	10000	15000
5/8	2000	3100	6650	8900	13350
3/4	1900	2900	6200	8300	12400
7/8	1700	2600	5600	7500	11250
1	1600	2400	5150	6850	10300
1 1/8	1500	2300	4850	6500	9750
1 1/4	1400	2100	4500	6000	9000

Carbide burs of the 1/4-in. shank size have heads brazed in place, and teeth are usually more closely spaced than on high-speed-steel burs

strated that a carbide bur will last up to 100 times as long as a high-speed-steel bur of corresponding shape and size. On the other hand, it costs about 15 times more. Assuming the production life of the carbide bur is 75 times greater and cost 15 times more, there is a ratio of 5:1 in its favor.

The carbide bur may be used on hard or soft materials with equally good results. Flutes of the carbide bur will retain maximum cutting efficiency a great deal longer, thus cutting changeover costs. A skillful operator, especially if he is working on a piece or bonus system, appreciates the fact that his tool is working at full efficiency and not reducing his earning power because it is partly worn out—although not sufficiently worn to be discarded altogether.

Tooth structure is designed with a negative rather than a radial rake to conform to the cutting characteristics peculiar to all carbide cutting tools. In general, teeth or flutes are also somewhat finer than those of a corresponding HSS bur. This construction produces greater tooth strength, together with best cutting ability.

Take Care of 'Em

Carbide in these burs has the highest Rockwell hardness consistent with necessary toughness. While every effort is made to combine hardness and toughness, carbide burs are nevertheless relatively brittle and must be treated more gingerly than an ordinary bur. Under no circumstances must they be tossed onto a bench or into a tool box where their cutting edges may be damaged, or where they would come into contact with other hard objects.

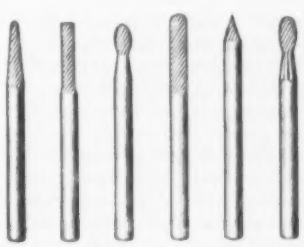
Use and Speeds

A comparison of the suggested speed for carbide burs with the chart for high-speed-steel files and burs leaves no doubt that carbide burs do a job in less time. At the same speeds, high speed and carbide remove approximately the same amount of metal. When carbide burs are used at their most efficient speeds, the rate of stock removal may be up to 400% as great as that of high-speed-steel burs. Care should be exercised to keep the carbide bur cutting freely to prevent too much pressure, which in turn causes vibration and may result in crumbling of the cutting edges.

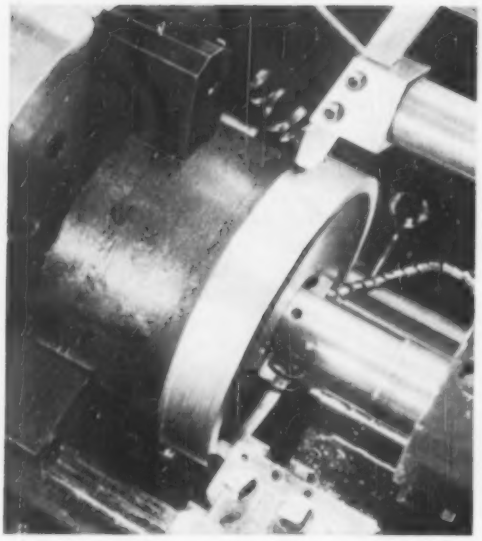
It is extremely important that carbide burs be not run too slowly; this causes shock to the teeth and is probably the principal cause of undue breakage. Care should be taken that they are not used in crevices or slots where wedging or jamming is likely.

Recommended Speeds For Medium-Cut Carbide Burs

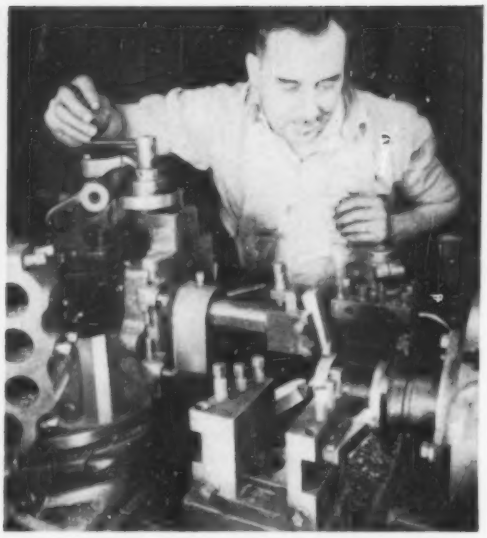
Dia. in.	Speed rpm
1/8	45000
1/4	30000
3/8	24000
1/2	20000
5/8	18000
3/4	16000
7/8	14500
1	13000



Integral type carbide burs with 1/8-in. shanks. These are adaptable to an endless variety of jobs and will outlast steel burs many times



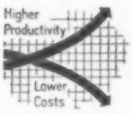
High-speed and cast-alloy tools are employed in machining large chrome-nickel forging. Tool on the OD is cast alloy, as speed on this surface is beyond range of good performance with high-speed steel. Tools in bore are high speed, as this application is well within their range. Speed, feed, and rate of tool wear are approximately equalized



Multiple cast-alloy tools replaced cobalt high-speed-steel tools for machining hard gray-iron casting and effected a 66 2/3% decrease in machining time. At same time, four times as many pieces are obtained per tool grind. Similar substitutions in tool materials often pay off in lower unit cost per piece with low initial investment

TOOL SELECTION CUTS MACHINING COSTS

Proper cutting-tool materials mean better performance and increased production. To guide users to efficient applications, key characteristics of major tool materials are given here



BY GEORGE T. FRASER, Manager
Rexalloy Division
CRUCIBLE STEEL CO. OF AMERICA

INDUSTRY today is giving more attention than ever before to the selection of cutting-tool materials. Seemingly slight differences between high-speed-steel, cast-alloy, and carbide tools are known to be important factors in lowering production costs. Furthermore, many machined parts now are made of heat-treated alloys rather than annealed machinery steels. To meet this change and still increase production, care in the selection of tool materials is imperative.

Yet, in many shops, antiquated tool selection practices totally ignore present-day tool-steel technology. Correct tool steels in these shops can result in 100% extension in tool life and a substantial increase in chip removal over tools now in use. Each application should be checked to determine whether the current material is best for the job from both the performance and cost points of view. As each tool material has its particular advantages, "savings by substitution" frequently are possible. It is only necessary to study jobs carefully to determine how and where to make the substitutions.

To form the basis for a definitive study of tool materials and their proper application, a review of the characteristics of the leading types is necessary. There are three major classifications of tool materials: high-speed steel, cast-alloy, and tungsten carbide.

High-Speed-Steel Group

There are approximately 15 different types of high-speed steels available, but for general tooling, virtually all requirements can be covered by eight grades. Chart I gives the composition of the eight leading types of high-speed steel.

Type A is commonly referred to as 18-4-1 high-speed steel and *Type B* as M-2, or moly-high-speed

Chart I . . . Chemical Composition of High-Speed Steels

Grade	Carbon	Tungsten	Chrome	Vanadium	Moly.	Cobalt
General-Purpose Tools						
A	0.73	18.00	4.00	1.10	—	—
B	0.83	6.40	4.15	1.90	5.00	—
C	0.85	18.50	4.00	2.10	0.75	—
D	0.73	14.00	4.00	2.00	—	—
E	0.75	18.00	4.00	1.15	0.75	5.00
F	0.80	14.00	4.00	2.00	0.75	5.00
High-Production Tools						
G	0.80	19.50	4.00	2.00	0.60	12.00
H	1.25	18.50	4.00	4.00	0.75	—

steel. These are general-purpose steels for all types of tooling. Both have good red-hardness and toughness and a wide hardening range.

Types C and D are vanadium high-speed steels and are for machining heat-treated alloys, sand castings, hard alloys, or gritty materials where toughness and resistance to abrasion are essential. Tools of this material will maintain a keener cutting edge than either type *A* or *B*.

Types E and F are referred to as cobalt high-speed steels and were developed to meet the requirements for a steel combining high red-hardness, superior abrasion resistance, and good toughness. These steels are recommended for severe cutting operations and especially for machining stainless steels.

Type G has a higher red-hardness and better crater resistance than the previous grades and is specifically recommended for heavy roughing operations where chip wear is a problem. Even with a high alloy content this material is tough and will withstand shock satisfactorily. For severe machining operations with heavy feeds, this grade should be used.

Type H, like type *G*, is a special-purpose high-speed steel and will give maximum performance in cutting extremely abrasive materials or under any condition demanding high anti-wear properties in the tool. This steel has high resistance to cratering and will run to great advantages under high speeds and light cuts. It is not as tough as type *G* but does possess better edge-wear resistance. It is recommended for broaches, reamers, cut-off tools, rifling and form tools.

Cast-Alloy Material

Cast-alloy materials were developed for cutting speeds in excess of those permissible with high-speed tool steels. Essentially, they fit a "middle range" between high-speed and tungsten-carbide tools. The material is a cast, non-ferrous, cobalt chromium-tungsten alloy having exceptionally high red-hardness, resistance to abrasive wear, and a hardness of 60 to 62 R_c (Rockwell *C*) which is unaffected by repeated heatings to elevated temperatures.

This material is group two in the cutting-tool classification and is satisfactory for machining cast iron, steel, and non-ferrous materials. It erroneously has been classified, at times, as suitable only for machining cast iron. Actually, cast-alloy tools are used extensively for the machining of all materials. It is both a general-purpose tool as would be used in a job shop and a production tool. The general practice in applying cast alloy tools to setups formerly tooled with high-speed steel is to increase the surface speed at least 25% while maintaining the same feed and depth of cut. Unless speed can be increased at least this much, there is no point in using cast-alloy tools. And if machine conditions warrant, this basic speed can be increased.

Chart II...Relative Hardness of Tool Materials at Elevated Temperature

Temp., °F	Brinell Hardness Number: Cast Alloy	Brinell Hardness Number: High-Speed Steel
1200	500	510
1400	475	220
1600	440	153
1800	415	137
2000	390	107

Chart II shows the relative hardness of a cast-alloy tool and an 18-4-1 tool at elevated temperatures, thus explaining why cast-alloys tools can be run at higher speeds and heavier feeds. Upon being cooled to room temperature from the elevated temperatures given in chart II, the cast-alloy tools will return to initial hardness of 60 to 62 R_c. High-speed steel will have to be rehardened.

Today, cast-alloy tools are used regularly for lathe tools, planer tools (providing the tool is not allowed to ride the work on the return stroke), boring-mill tools, cut-off tools, milling of cast iron, reamer blades, and form tools. They are ideally suited for those machining operations where high chip removal per minute is paramount.

Tungsten-Carbide Material

For maximum production and tool life it is necessary to adapt tungsten-carbide tools to the machining application. These tools are classified by the machining required—i.e., whether the material to be machined is steel, cast iron, or non-ferrous metal, and, whether it is hard or soft, and is to receive a roughing or a finishing cut. For machining cast iron or non-ferrous metals, tungsten carbide tools are recommended, but for the machining of steel, titanium or tantalum is added. Thus, there are two general types, which, in turn, are divided into various grades. Depending upon the nature of the machining operation, a specific grade is selected for roughing and one for finishing. A further specification is whether or not the operation calls for a crater-resistant type or a grade with high resistance to edge wear.

Tungsten-carbide tools have the highest red-hardness and best resistance to cratering and edge-wear of any material in the three classifications. They are not as flexible in their usage, however, because their performance depends upon the condition of the machine tool,

Chart III . . . Surface Speeds for Single-Point Tools — FPM

	High-Speed Steel	Cast-Alloy Steel	Tungsten Carbide
Free-Cutting Mild Steel	120-200	120-250	250-500
Plain Carbon Steel — 20 C	80-100	160-200	200-450
40 C	75- 90	100-180	200-400
80 C	60- 80	70-150	150-350
SAE 3115-3450	30- 75	50-110	100-300
SAE 4130-4820	30- 80	60-135	100-350
Cast Steel	30- 80	60-150	150-250
Cast Iron — 150 BHN	60- 80	80-175	175-250
250 BHN	30- 50	70-125	150-200
Brass	250-400	250-600	500-1000
Aluminum	250-400	250-700	600-1000
Stainless Steel — 18-8	60-100	120-225	150-350

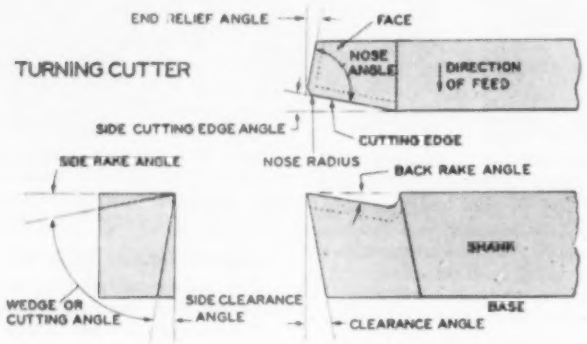


Chart IV . . . Cutting Angles for High-Speed-Steel, Cast-Alloy, and Tungsten-Carbide Tools

NAME OF ANGLE	TOOL MATERIAL	DEGREES OF EACH ANGLE FOR VARIOUS METALS				
		Cast Steel	Cast Iron	Bronze	Steel	Stainless Steel
Side Rake Angle	HSS	7	0-5	4-8	8-20*	8-20**
	C-A	7	0-4	4	5-20*	8-20**
	T-C	6	0-4	4	5-10*	8-20**
Side-Cutting-Edge Angle	HSS	10	10	10	10	10
	C-A	10	10	10	10	10
	T-C	10	10	10	10	10
Side Clearance Angle	HSS	5	5	5	7	7
	C-A	5	5	5	7	7
	T-C	5	5	5	7	7
Back Rake Angle	HSS	8	0	5	8-20*	8-20**
	C-A	0-5	0	0-5	5-20*	8-20**
	T-C	−2, −0	−2, −0	−1, 4	5-20*	0-5**
End Relief Angle	HSS	5-10	5-10	10	5-15	15
	C-A	5-10	5-10	10	5-15	15
	T-C	5-10	5-10	10	5-15	15
End Clearance Angle	HSS	5	5	5	7	7
	C-A	5	5	5	7	7
	T-C	5	5	5	7	7

* Angle depends upon grade and type steel being machined. Generally, the harder the steel, the less the rake angles should be.

** Angles for stainless steel and Monel are dependent on the grade and type being machined.

care of handling, and proper application. Used properly, their performance usually far exceeds that of high-speed steel or cast alloy.

Chart III presents the surface speeds recommended for the machining of different materials with the three different types of cutting tools.

Cutting Tool Designs

All cutting tools employ a wedge action and the included angle of the tool, at the cutting edge, made by the rake and clearance angles is called the "wedge angle." For hard, brittle materials, such as cast iron and brass castings where the chips break or crumble easily, the cutting or wedge angle should be very large. For softer and more ductile materials, such as copper, aluminum, and low-carbon steels where the chips do not break easily, the cutting or wedge angle must be smaller so a greater shear action results.

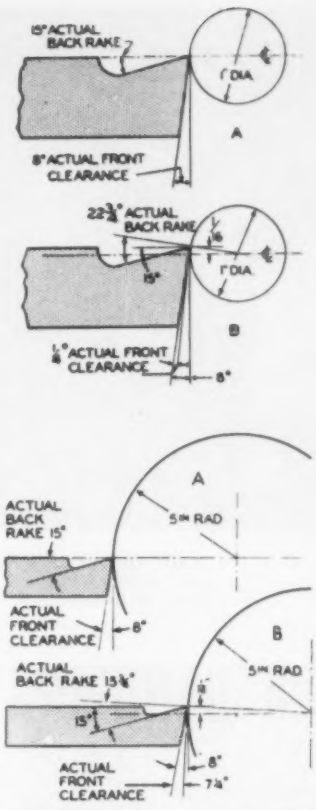
Conventional angles for high-speed-steel tools are readily adapted to cast-alloy tools but must be modified somewhat for carbides, as it is essential to maintain a maximum "wedge angle" on carbide tools. If the carbide tool is to be subjected to impact, a negative rake angle is necessary so maximum support will be given the cutting edge. This also holds for cast-alloy tools but to a lesser degree. Chart IV shows recommended cutting angles for the three different classes of cutting-tool materials. It will be necessary to vary the rake angles, depending upon the hardness of the material being machined, to control the chip flow.

Of the three classifications, high-speed-steel tools can be abused more than any other. Furthermore, they often perform fairly well even if ground with improper tool angles. Cast-alloy and tungsten-carbide tools must be ground properly for maximum performance. Improper grinding will decrease their tool life much more severely than is the case with high-speed steel. These two materials are more likely to fail from chipping and breaking than high-speed-steel tools as their edge strength is dependent upon the support given to the cutting edge. It is definitely recommended

that all cutting tools be honed after grinding to remove any grinding burr adhering to the cutting edge. The honing of high-speed-steel tools will increase their tool life by at least 10%. Honing of the cast-alloy and tungsten-carbide tools will eliminate premature chipping of the cutting edge.

Clearance

Clearance angles always should be kept at a minimum. The more metal there is under the cutting edge, the more support there is for the downward pressure of the chip and the longer the cutter will stay sharp. Tools having too small a clearance angle have a tendency to chatter; those having too small a clearance angle will rub against the work and either refuse to feed or suddenly dig into the work. Proper clearance angles are determined by the position of the cutting tool with respect to the work. For instance, a tool having an 8° front clearance angle machining a 1-in. round and set to the center of the work will cut satisfactorily. But if this tool is set 1/16 in. above the center of the work, the actual front clearance will only be ¼°. On large diameter stock, one has greater leeway in the position of the cutting tool with respect to the center of the work. For example, a tool having an actual front clearance at 8° set on center for machining a 10-in. round will have an actual front clearance of 7¼° if set 1/16 in. above center.



Tool setting with reference to centerline of work affects actual clearance and rake angles considerably more on small-diameter work than on large

Chip Flow

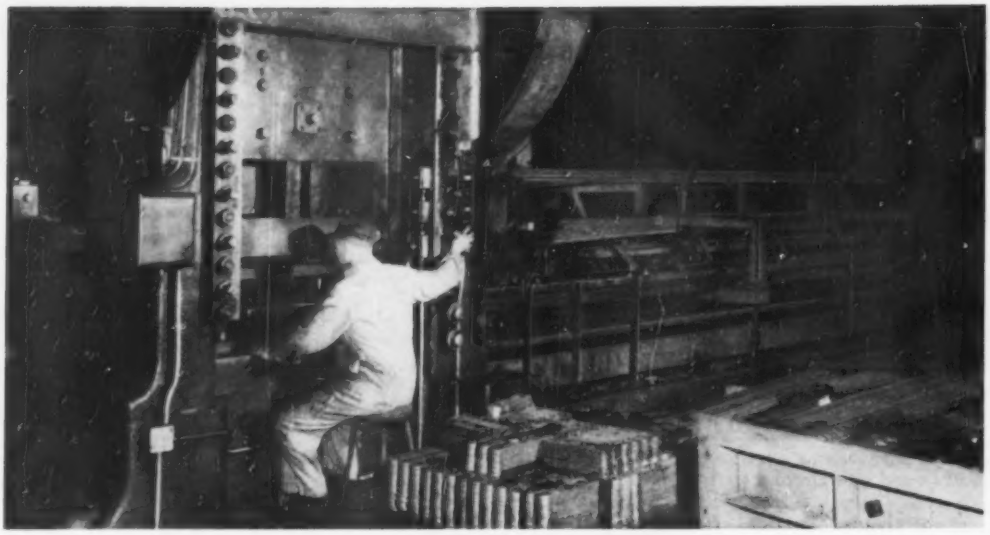
Once a tool is in operation, corrections can be made in the rake angles to improve chip flow. On heat-treated steels, if the chip does not break or curl properly, the lead angle should be increased. The correction also can be made by decreasing or increasing the side or back rake. In changing over from high-speed-steel cutting tools to cast-alloy or tungsten-carbide tools, it is necessary to change the rake angles. Speed is increased, and the more rapid the chip flow, the more need for chip guidance. On cast alloy and carbide tools, this is usually governed by a chip breaker ground on the tool or by a mechanical chip breaker. If the chip breaker is ground on the tool, either a parallel or angular type is preferable to the groove type of breaker. It is not uncommon to find an operator who believes that it is necessary to grind the groove very deep and to omit any land on the cutting edge. This practice probably dates back to the time when carbon tool steels were used extensively. It then was necessary to grind a tool so it would cut freely and with a minimum of frictional heat. This practice cannot be followed with modern high-production tools as edge failure will be very rapid.

Regardless of how well a tool is designed, its performance will depend a great deal on the care and attention given to grinding. The majority of tool failures are not the fault of the tool itself, but the fault of the man that ground the tool, as most failures are caused by grinding checks on the tool. Sufficient emphasis has not been given to the detrimental effect of grinding checks on tool performance. Before condemning a tool for poor performance, it first should be determined if the tool has been improperly ground.

Grinding checks are caused by too-rapid removal of stock in grinding. This may be from too heavy a feed or improper grinding wheels. Each of the three tool materials can be ground best by the wheels recommended by the grinding-wheel manufacturer. It is folly to expect good results if tungsten-carbide tools are ground by wheels recommended for high-speed steels, and vice versa. For many grinding operations, however, high-speed-steel tools can be ground satisfactorily with any wheel recommended for grinding cast alloys. If it is necessary to economize on tool costs, please do not try to save money through the purchase of improper grinding wheels because of their price or through selection of exceptionally hard wheels for long life. Such a move can do nothing more than increase your tool costs. It is best to rely upon the recommendations of your grinding-wheel vendor to accomplish most efficient and economical grinding results.

Applications

Thus, the nature of the machining operation will be the major factor in determining the type of tool which should be applied. While high-speed-steel tools are usually solid, cast-alloy and tungsten-carbide tools are often employed as tipped tools. These two materials must be applied as tipped tools on machining operations entailing heavy tool pressures and impact. During the past few years there has been a growing interest in solid cast-alloy and tungsten-carbide inserts which are held in position mechanically. These tools are very efficient and practical as they are readily reground and the possibility of brazing cracks is eliminated.



Single operator sets up stock-feeding mechanism and runs 1 big press continuously to blank out heavy chain links like those in foreground. Bar stock is 10 to 20 ft long. **Feed is from . . .**

COMPLETE STOCK HANDLING AUTOMATIZES

BY ERNEST G. NOREEN, Supt. Tool Design, LINK-BELT COMPANY

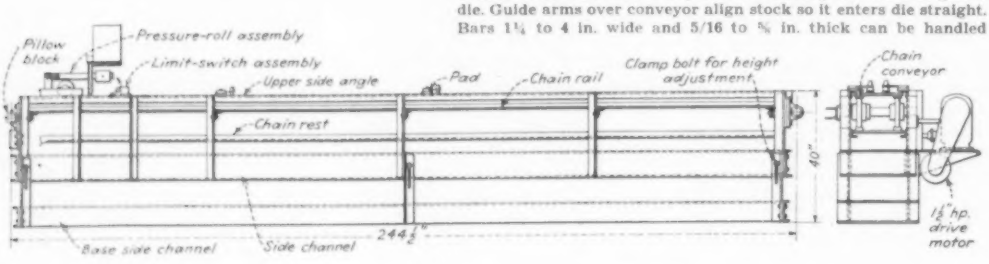
MILD-STEEL and carbon-steel side links for heavy chains are produced at Link-Belt's Pershing Road plant with a punch-press setup that keeps only one operator busy. A feed rack is combined with a pusher unit to move bar stock into the press, and a special elevator removes links and scrap from the press pit.

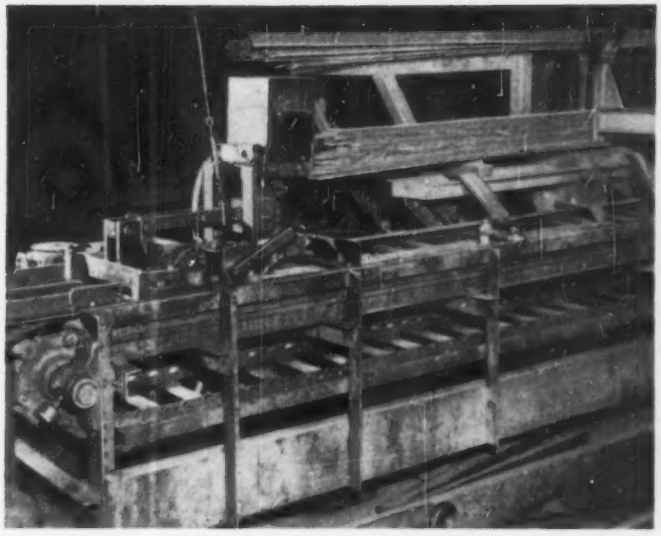
The 88-slat conveyor moves bar stock singly into the press, and is fed, in turn, by a pusher unit that stacks bars. Stop arms on the unit extend through the conveyor and locate bars that are dropped off the bottom of the pile by sliding plates.

A pressure roll on the conveyor rack presses the bar stock down against the conveyor slats, which move the bar into the press by friction. This action is stopped during the stroke of the ram by a cable that lifts the counterweight and relieves pressure exerted by roll.

The automatic feed plus the scrap elevator make it possible for one operator to run the press with only materials handling aid in loading the pusher unit and removing filled link and scrap barrels. The 500-ton Minster press operates on a continuous cycle. New setups can be made by the regular operator.

Welded-steel feed rack is adjustable vertically to match height of die. Guide arms over conveyor align stock so it enters die straight. Bars 1¼ to 4 in. wide and 5/16 to ⅝ in. thick can be handled

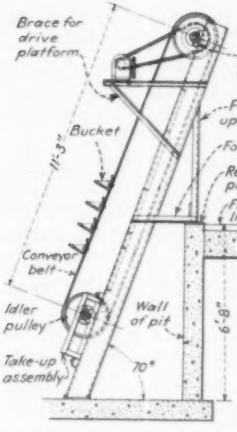




2 . . . **pressure roll** that grips bar and runs it into die. Cable from counter-weight to press crankshaft interrupts feed when ram descends by lifting weight to relieve pressure. **Power to** . . .

3 . . . **conveyor** on rack is from 1½-hp motor through adjustable drive and gear reducer. Conveyor speed is adjustable. **Behind press a** . . .

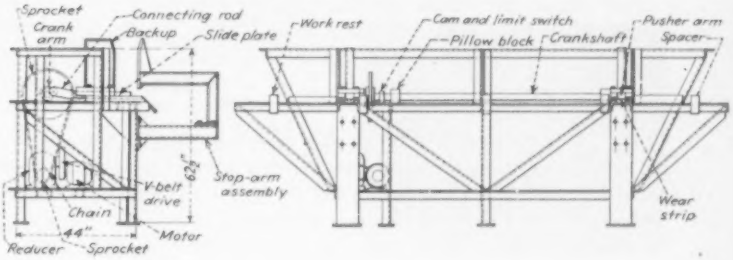
PUNCH PRESS



Elevator buckets are divided into three compartments so they can lift links and scrap at the same time. **Drive** motor is on platform above floor and out of the way

Pusher unit is stacked with bar stock and feeds bars individually onto conveyor. Limit switches control action so one bar is pushed off the bottom of the stack as the previous bar starts to clear the feeder

4 . . . **scrap elevator** lifts links and scrap from chutes under die openings out of press pit and into barrels. Complete materials-handling cycle requires only loading of conveyor and removal of barrels



ROUND TABLE

Employment Preview

"Bowman sent a fellow in to me today. Bowman thought I should have a talk with him before he hired him. It's the first time that's happened. Wonder what's come over the man?"

"Don't you like the idea, Ed?"

"Certainly. In fact, I've gone to bat with Bowman lots of times because he took on men I could have spotted as four-flushers."

"But, Ed, you have too many things to look after now—let alone spending a lot of time interviewing men who are looking for work."

"You're not talking through your hat when you say that, Al, but I'd a lot rather know who's coming to work in my department."

"Don't you think that Bowman can detect a man who isn't genuine after all the experience he has had in interviewing applicants? How many fellows have been sent to you in the last six months who weren't as good as Bowman thought they were?"

"Well, I can't say offhand, Al, but there were some I know for certain pulled the wool over Bowman's eyes. There was one chap I recall particularly who, had I been able to talk with him, certainly wouldn't have started in on the job."

"Did you take the matter up with Bowman at the time?"

"I certainly did, and Bowman said that the fellow put up a pretty good story about his experience."

"And now you're going to take your valuable time to see that someone else doesn't slip through the line, eh? What do you expect to gain for your trouble?"

"In the first place I can tell whether a man is stretching a story; in the second I like to know what I'm getting. Bowman is no mechanic and can't tell a good mechanic from one who just talks good mechanics."

"I know that, Ed; the man can't be everything."

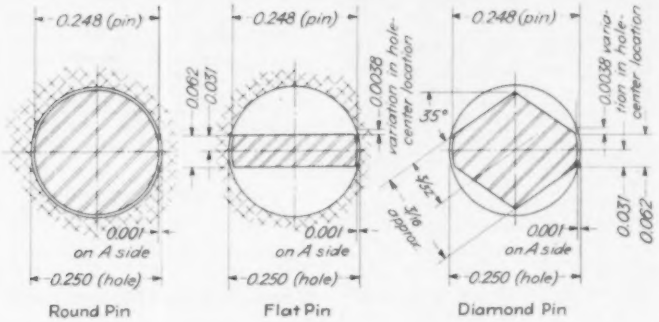
"That's just the reason why I say that it is up to the foreman to have the say if a man is to be hired or not."

"You're a pretty good fisherman, Ed," laughed Al. "You take delight in dangling the bait until the fish is well hooked."

"Well, at that, I can avoid catching an old boot."

***SHOULD A FOREMAN**—or other supervisor—interview a prospective worker, or leave hiring to a specialist? Are there advantages to the prospect in being interviewed by a man who can appreciate his experience? Your ideas or opinions on this question will interest others. Discussions of earlier topics appear on later pages.*

Practical Ideas



Diamond Sections on Locator Pins Provide More Strength

LOCATOR PINS for milling and profiling fixtures are usually ground for a slip fit; yet must allow for some variation in center distances.

Often a single round pin is employed with a flat pin, because a slip-fit clearance of 0.001 in. on the flat pin will allow ±0.0038 in. variation in the part in a direction perpendicular to the flat on the pin.

However, flat pins are weak, and if round pins are employed throughout the fixture, no allowance for variations can be made. One solution is to employ pins with a diamond cross-section.

The pins will have the advantages of the flat pins in that about the same amount of round can be left on each side of the pin. Yet greater strength can be built into the pins if the sharp edges of the diamond are brought out nearly to the circle of the round-pin section. This provided about double the cross-sectional area and much more rigidity. *Edson C. Bates, W. Babylon, L. I.*

Bearing Plate Supports Heavy Work on Saw Table

SAWING HEAVY flat stock is a tough job when the metal must be shifted around on the saw table. Sometimes small rods can be placed under the stock so it can be rolled back and forth, but if profiles have to be sawed, the stock must be rotated, too. To ease such a job, a bearing plate can be made to fit under the stock on the saw table.

Take a plate of fairly soft steel that is slightly thinner than the diameter of a number of bearing balls that may be available. Next saw out or drill out holes in the plate slightly larger than the balls. The holes should be in a pattern that will support the plate, and any work that is placed on top of the plate, evenly. Take a centerpunch and indent the sides of the holes so projections of the metal will form a diameter smaller than the balls. Then turn the plate over, drop the balls in the holes, and support the plate so the balls will project through the holes slightly. Finally peen the edges of the holes from the side that is now on top to retain the balls in the holes. The indentations should be strong, but should not bind the balls.

When a large plate has to be sawed, lay the bearing plate on the saw table and mount the work on top of it. The work can now be easily rolled back and forth, twisted, or rotated to any position. *Basil Clark, Evansville, Ind.*

Mark Your Jigs Clearly

MANY JIGS and fixtures are poorly marked with numbers out of line and not equally impressed. If a few simple rules are followed, code numbers can be stamped, so they will be readable for a long time.

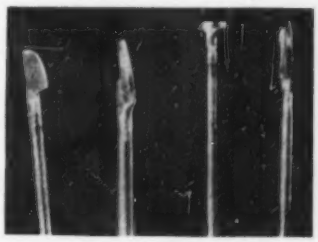
1. Always use guide lines to keep the words straight and even.
2. Always lay out letters before they are stamped to make sure they are evenly spaced.
3. Stamp numbers and letters in reverse order so that previously stamped letters can be easily seen.
4. Use a heavy hammer.
5. Support the work on something solid.
6. Never restamp a number that is poorly marked. Start over again in a new place to avoid confusion. *Leonard A. Kroll, Brooklyn, N.Y.*

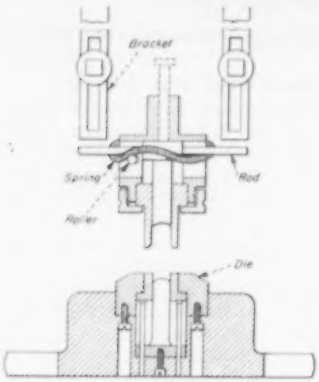
Toolroom Scrapers Made With Carbides

SCRAPERS for reconditioning and finishing machine-tool slides, bearings, ways, and other surfaces can be made by brazing cemented-carbide blanks to old files and then grinding them to shape.

These improvised scrapers have been found to last longer than steel scrapers by maintaining a clean, sharp edge longer. The carbide scrapers also reduce grinding time that is required. Carbides show no tendency to scratch or gouge.

A 4° negative rake can be ground on the tips with a 220-grit diamond wheel. This eliminates any tendency towards jarring or chattering. *Carboloy Co., Detroit, Mich.*





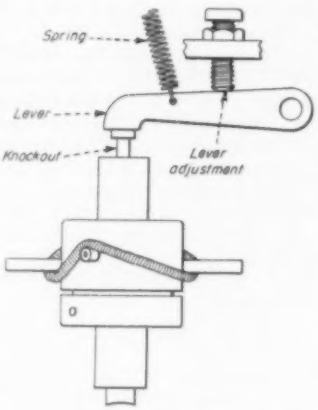
Endless Knockout Spring Located Outside Punch

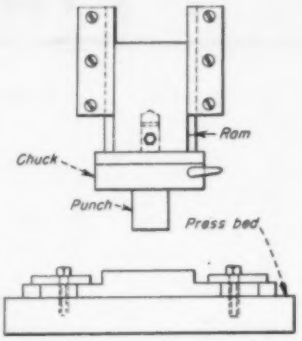
I HAVE HAD quite a bit of trouble with knockout-return springs in drawing punches—most of it because springs are commonly too short when they are placed inside the punch body. Punches made large enough to contain large springs are too large, otherwise.

An endless tension spring can do the same job, yet can be placed outside the body of the punch where it will not affect punch design. Such a spring can be as strong as necessary without being too much in the way. An external spring is also easier to replace when and if it breaks.

The spring is attached to the punch assembly by looping it around two rods that extend from a collar that is fixed on the knockout. Small rollers screwed into holes in the punch body also support the spring. Action of the knockout spring is thus: As the punch raises after a stroke, two brackets are struck by the rods extending from the knockout collar. The knockout is depressed in relation to the punch—although it actually stays in one place while the punch moves up—against spring pressure. The spring is retained by the small rollers.

Second arrangement of the spring is for a Bliss-press setup. The spring is located in the same way, but the knockout is operated by a lever that is adjusted in position by a screw fixed to the press ram. *Burnett Menkin, Bronx, N. Y.*





Magnetic Chuck Mounts Punch

EXPERIMENTAL PARTS, punched from sheet stock, were produced cheaply by mounting a magnetic chuck to the ram of a tryout press.

This held new punches with fairly large bases firmly enough to knock out a few parts with each setup. The dies for the same jobs were made as simple as possible, and were clamped to the press bed. *John F. Bell, Tuckahoe, N. Y.*

Base Waxes Coat Wood Pattern For Pantograph Reproduction

MASTER DIES and cavities for plastic molds are cut on a die-sinking machine with a pantograph follower that traces a master pattern. Normally the patterns had to be made in bronze, then chrome plated, or made in some other metal. The process is slow and expensive.

My hobby is skiing, and I knew that base waxes that are applied to skis are smooth and hard so they can both protect and provide friction-free surfaces. So we tried making a master pattern in our shop from wood, then finishing it with base skiing wax.

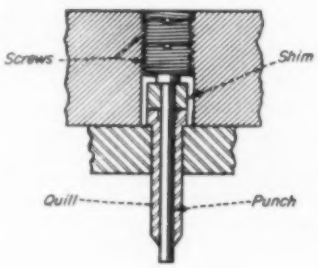
The wax dried hard, and we found that a number of coats, applied between sufficiently long waits for each coat to harden and set, provided a surface that could be followed by a pantograph. A box-lid pattern, for example, was coated three times.

Using the waxed wood patterns has cut down master costs drastically. *Wm. Bruce Johnston, Toronto, Ontario.*

Quill Punch Simplifies Removal and Repair

THE QUILL-TYPE punch assembly shown has these advantages:

1. Punches can be bought or made extra long. As the punch is ground off, the shim can be also ground, which brings the punch back to its original position.
2. Punches and quills can be replaced without removing the punch plate. The punch plate does not have to be counterbored.
3. Similar assemblies can be employed for pilots, which simplifies removal for repair work.
4. When standardized, the assembly can be purchased cheaper and will be more accurate. *A. M. Philbrick, Hartford, Conn.*

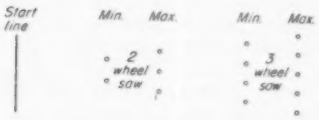


Centerdrilling Setup Made With Gripper Plate and Steady

NOT LONG AGO I had to drill some large center holes in several 3-in. shafts that were 3 ft long. This sounds like a cinch, but unfortunately I had no lathe available that would take the stock through the spindle or swing it between centers.

I did have a lathe with both a boring-bar turret and a steady-rest, so I set the rest accurately to the 3-in. diameter and then welded a piece of ⅝-in. scrap plate to the end of a piece of bar stock that would fit in the turret. This was lined up perpendicular to the lathe spindle, with the turret back on the carriage to clear the work, and was bored to a close fit for the stock I had to center. A setscrew was added through the edge of the plate to clamp the stock.

The setup was made with an end of the stock gripped in the plate, and with the rest of the stock supported in the steadycrest. A centerdrill was chucked, and the stock was fed by the turret feed off the leadscrew. The job turned out well —holes dead center and smooth. *Yates R. Bands, Jackson, Miss.*



Floor Layout is Reference For Bandsaw Lengths

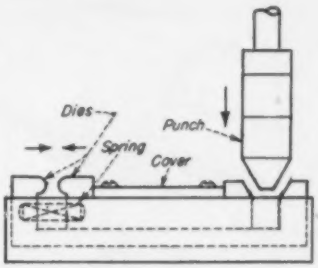
THERE IS nothing quite so aggravating as to prepare a new blade for a Do-All saw, weld it, and then find that it is too short or too long.

A simple way to have easy reference to the correct length for replacement is to hammer carpet tacks into the floor (if it is of wood-block construction) at the proper distances. Our saw is a three-wheel type, so we use two lengths of blades. Starting from the base of the machine, the layout is as illustrated. *Bernard Levowich, Brookline, Mass.*

Sideswiping Forming Punch Produces Small Parts

CLOSING AND FORMING operations done with punch press can be made safer for the operator who feeds in parts by hand if an extension punch is made. This idea also makes feeding easier by moving the job out into the open.

A large block is milled out and machined so it can be bolted down on a press bed. It holds one die block, and the smaller die block rides inside the larger one. A wedge-shaped punch is employed, and the setup is made so the punch will force the two die blocks apart when it strokes down. This moves the blocks closer together at the other ends to do the forming job. The larger die must slide on its base.



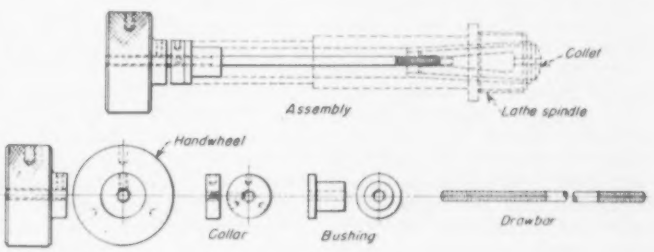
Forming dies can be machined right on the blocks, or can be made separately so they can be screwed into position and replaced. A spring between the blocks opens them after the press stroke. A cover plate retains the smaller die in the larger one. *Mark N. Kert, New York, N. Y.*

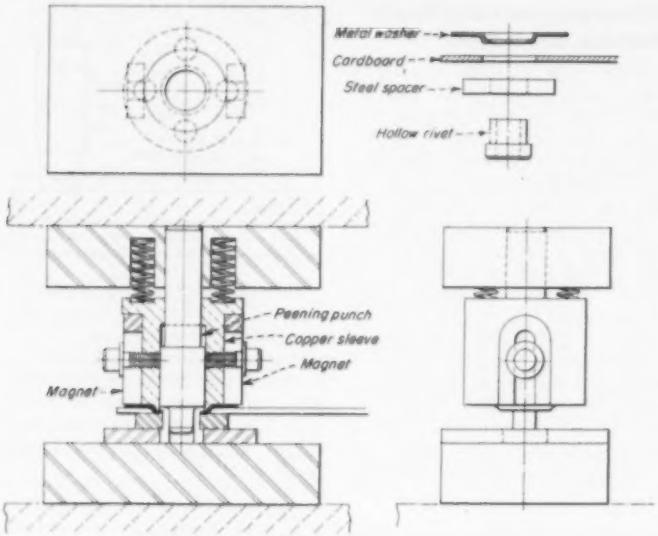
Collet Adapter Fits Small Lathe For Short-Run Jobs

ENGINE LATHES can be converted for collet operation with standard collets with an easily made adapter that fits in the spindle. Four parts are required: a drawbar, a handwheel, an adjusting collar, and a drawbar bushing.

All parts have to be proportioned to the lathe at hand, so no dimensions are given. Bridgeport milling-machine collets were employed in the adapter that was originally made, so the drawbar was turned and threaded to fit them. At the other end of the drawbar the bushing is pressed into the end of the spindle. It is a reamed slip fit for the drawbar. The simple knurled handwheel and adjusting collar are fitted with setscrews and threads to mount on the end of the drawbar so they will pull the collet in.

Two methods of operation are possible: for one, the operator can use the handwheel to enter the drawbar in a collet, then tighten up the collet in the Morse taper of the spindle nose with the adjusting collar. A faster method is possible if a small pin or button is added to the Morse-tapered spindle, near the small end and close to the back end of the collet. Each collet can be slotted longitudinally with a cutoff wheel so that it will be prevented from rotating in respect to the spindle when it is pulled back by the handwheel alone. In this case the adjusting collar is not necessary. *Allan B. Nixon, Springfield, Mass.*





Magnets Preposition Washer For Press-Assembly Job

AN ASSEMBLY OPERATION in our shop called for riveting together a steel spacer, a washer, and a strip of cardboard with a hollow rivet. These were located on the press by fitting the rivet into a locating hole, placing the spacer over the rivet, then adding the cardboard and the washer. Unfortunately, though, the cardboard would not lie flat, and would spring up and dislodge the washer.

We got around the trouble by adding two horseshoe magnets to the punch assembly of the press. They were on the sides of a spring-pressure sleeve that worked outside the actual punch. Parts were placed on the die as usual except that the washer was slipped over the punch and up to the magnets, where it was held by magnetic force. As the ram descended, the sleeve brought the washer down first, in perfect alignment, before the punch struck. It was an easy matter to keep the cardboard in alignment until the assembly was completed, and the result was a neat and trouble-free job. *Kenneth L. Stoltenberg, Milford, Mich.*

Short Trigonometry Rule Sets Up Small Angles

ANGULAR DIE CLEARANCES, drafts on plastics dies and casting dies, and some angles on cutting tools are normally small angles and do not have to be formed with high accuracy. A simple application of trigonometry can be employed to make the setup for cutting these angles quick and easy.

The rise, or sine, of a 1° angle is 0.0175 in. per inch, roughly, and the rise for any angle up to 5° is proportional within 5 min. Up to 15° the rise is proportional to that figure within 13 min., so this fact can be used to find the rise for a small angle.

For example, if a steel block's edge has to be machined at an 8° angle, 8 times 0.0175 in. is 0.140 in., which will be the proportional rise. If the block is 5 in. long, the total rise will be 0.140 in. times 5 or 0.700 in. A gage block of that thickness, or simply a steel block cut to that thickness, can be set up under the edge of the 5-in. block to prop it up at 8° (within 13 min).

The system is more accurate than a bevel protractor, especially on small angles, and provides, in addition to the angle itself, a support for the work. *O. Ernest Riegner, Philadelphia, Pa.*

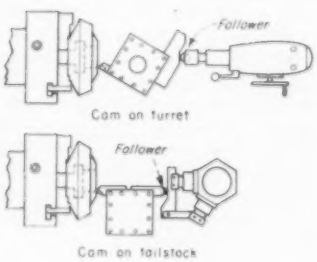
Square Lathe Turret Supports Cam for Profile Turning

CIRCULAR-CUTTER forgings were form-turned with a setup that had a number of advantages over hand feed, aside from increased production. The forgings that were turned had already been bored, so feed was outward from the center of the work. This allowed the tool to start the cut in clean metal instead of rough surface skin.

The cutting tool and cam were clamped in a square indexing turret that replaced the regular toolpost. The cam follower, which was mounted on the tailstock, was a small sealed ball bearing mounted in a yoke that was machined with a tapered shank to fit the tailstock. The bearing was small enough that the tendency to round out the angular profile on the cam was slight enough that it did not seriously affect the finished work.

Binding in the turret movement and excess lost motion were cut to a minimum by having the tool and cam at the same height so the turret was not tilted by pressure.

An alternate setup for large work can be made with the cam on a hex turret in place of the tailstock, and with the follower on the square turret. In a case like this, it would probably be necessary to brace the cam, which could be done from another hole in the hex turret. *Hugh L. Hixon, Long Beach, Calif.*



~~44~~	x	~~321~~
~~22~~	x	~~642~~
11	x	1284 ✓
5	x	2568 ✓
~~2~~	x	~~5136~~
1	x	10272 ✓
		14124

Check Your Shop Mathematics—II

THE RECENT ARTICLE by Ray Cafiero on shop multiplications reminded me of another method which is quite simple. It only requires mental multiplication and division by the factor 2, plus some adding.

Taking the two numbers used in the other article, multiply 44 by 321 this way:

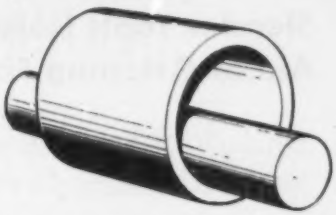
Set down the two numbers next to each other, and start building a column down from each of them. Divide the first number by 2, and multiply the second by 2. Disregard any fractions or remainders when you divide.

When the first column gets down to 1, cross out all lines where the number in the first column is an even digit. Finally add all the numbers that are left in the right-hand column to get the result.

This method is better when the numbers get more complicated, and works fine when one is a fraction—just put the fractional number on the right side. *William W. Johnson, Cleveland, O.*

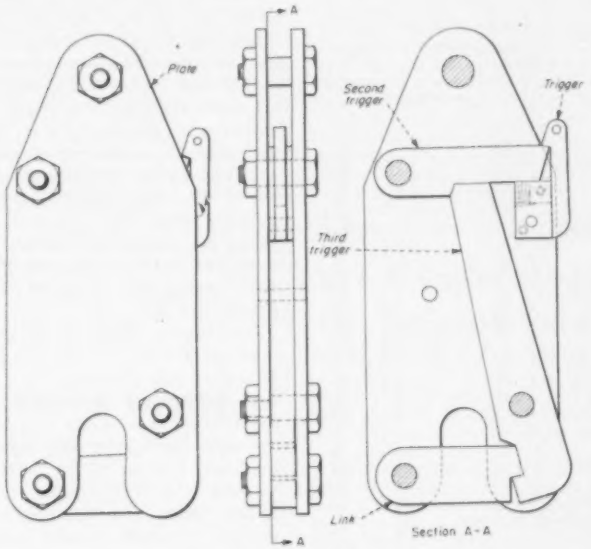
REMOVING SCREWS from inaccessible spots is not usually too difficult, but getting them back in place is the tougher chore. When special screwdrivers are not on hand for such a job, an ordinary driver can be forced into the screw slot inside a piece of paper or matchbook cover. This will usually cram the end of the screwdriver enough that the screw will be held until it can be inserted. *Frank Biechele, Brooklyn, N. Y.*

Simple Throw Cam Made From Shaft and Tube



MANY QUICK-ACTING clamping devices for jigs and fixtures utilize the throw of a cam that is mounted on a hand-rotated shaft. Usually these cams have to be drilled, then mounted eccentrically on a chuck and turned.

If a simple eccentric cam is suitable for the throw action, a piece of steel shaft can be welded to the ID of a piece of tubing as illustrated. The cam can then be mounted in the fixture by means of the shaft. *Paul H. Winter, Syracuse, N. Y.*



Heavy-Load Trigger Releases Recoil Mechanisms in Tests

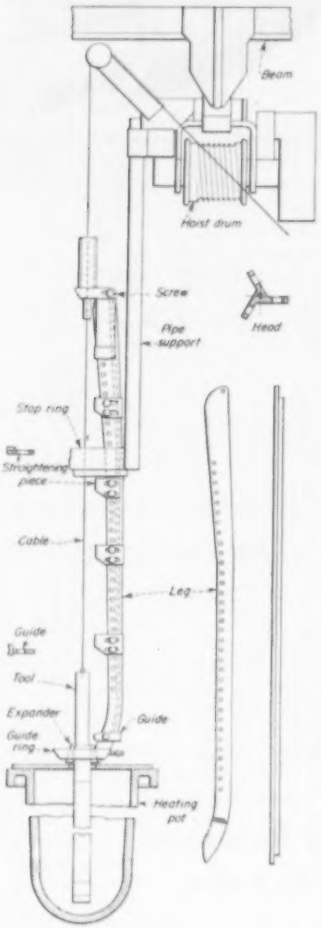
RECOIL MECHANISMS for field guns must be tested for speed. Control valves in the mechanisms can then be adjusted so the recoil will be timed right and no damage will result to the gun. In such tests, 6-ton loads are applied to the end of the tube and are released instantly.

With such a heavy load and the requirement for instant release, a special trip had to devised. The illustrated linkage was made and performed satisfactorily.

A lanyard is attached to the small trigger. When this is pulled, the trigger backs off the second trigger as the spring-loaded plunger in the first trigger throws the second trigger up. When this happens, the third trigger is released by the shoulder on the second trigger and flies to the left until it hits the stop peg. With this motion, the third trigger releases the link that closes off the slot in the end of the body of the mechanism.

Wire rope is looped through the slot, around the link, and connects the gun, through the mechanism, to the loading device. *R. B. Wolverhampton, Staffordshire, England.*

Slender Tools Hardened with Aid of Gripping Fixture



LONG REAMERS, gages, and broaches are kept from distorting right after they have been heated and before they have been quenched by a rig that works from a shop crane. Gripping pieces on three legs are adjusted to the shape of the tool and tighten as it is raised to be moved to a quench pot.

On the heating pot there is an expander ring, added to locate the ends of the three legs. When the tool, supported by a wire cable screwed to its end, is in the pot, the legs are supported by the expander. A guide ring at their ends keeps them confined.

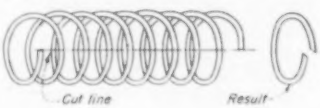
A head at the top ends of the legs holds them together, and a retaining ring and spring about a third of the way down also help to hold the legs in position. This retaining ring is supported from the crane by means of a pipe and bracket.

A number of straightening pieces, bolted to the legs through slots that allow adjustment radially, are fixed so when the tool is raised up to the head, they will grip on it as the cable pulls up the whole assembly and releases the legs from the expander on the pot. Rigidity of the part while it is being transferred to a quenching station is assured when the straightening pieces are located correctly. The weight of the legs, plus the force of the spring, will force the pieces against the part.

Operation is fast when the cable is pulled sharply to raise the part from the bath. The tool strikes the head and lifts the fixture, and then the fixture closes on the tool. If an operator stands near the quenching bath, friction of the hoist on its rails will be overcome as the fixture raises, and the whole assembly will move to the quench pot. Once centered, the tool can be dropped into the pot as it was lowered into the heating bath. *Alberto Somigli, Rio de Janeiro, Brazil.*

Springs Cut for Lockwashers

WHEN LOCKWASHERS of a required size are not in stock, and a spring of the right diameter can be found, the spring can be cut down one side to form a number of workable washers. The springs can best be parted with an abrasive cutoff wheel. *Frederich Jerome, Cincinnati, O.*



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Toolbit Clamped On Reamer

NEWS OF METALWORKING

Czech Metalworking Exports Show Increase

PRAGUE (McGraw-Hill World News) — Czechoslovak metalworking exports are rising with the increased production. Some of the few figures published nowadays appeared in a newspaper paragraph recently. Comparing 1948 exports with 1937, and taking the 1937 exports at 100%, then 1948 exports for some items were:

Locomotives, 2258%; electric machines and instruments, 442%; machine tools, 321%; sewing machines, etc., 280%; food industry machinery, 234%; agricultural machinery, 142%; railway wagons, 1666%; autos, 260%; motor cycles, 53,010%; cycles, 6675%; scientific instruments and equipment, 213%.

Metalworking products are Czechoslovakia's most important exports.

Competition Demands Cost Reducing Tools; More Sales Probable in 1950

CLEVELAND—On the basis that today's outstanding business characteristic of severe competition demands reduction in costs, David Ayr, president of National Machine Tool Builders Assn. and head of Hendey Machine Co., Torrington, Conn., believes it probable that shipments of machine tools to manufacturers in 1950 will exceed those for 1949.

In a statement released at the close of the year, Mr. Ayr said that the industry's outlook for 1950 may be improved if "circumstances should work out in such a way as to permit manufacturers abroad to buy more machine tools of American make, instead of confining their purchases to their own countries."

A stimulus to machine tool sales would likewise result, he said, if Congress next year should, in its new tax law, direct the Internal Revenue Dept. to relax its present policies with respect to depreciation schedules.

Throughout 1949, Mr. Ayr pointed out, the machine tool industry operated at a level slightly below that for 1948. For 1949, with December estimated, total shipments will be in the neighborhood of $250 million, as compared with $274 million for 1948.

"The decline from 1948 reflects the business uncertainty of midsummer, the coal and steel strikes in the fall, and currency and devaluation difficulties hampering foreign sales. Shipments turned upward, however, toward the close of the year, indicating a growing realization of the fact that, come what may, replacement of obsolete machines by new and better models is, under today's competitive conditions, essential to survival."

Labor Share in Cost Cutting Urged To Make Possible 1950 Wage Hike

WASHINGTON — AFL economists are telling AFL contract negotiators that, even with the prospect of lower profits in 1950, employers can grant wage increases of from 7 to 15 cents an hour this year by "reducing costs."

An invitation to management to give employees a chance to cooperate in cost reduction programs as a means of providing higher wages is extended in the December issue of "Labor's Monthly Survey," the AFL's economic bulletin.

"Most American managements have never seriously tried to cooperate with unions by submitting cost data and assuring union members of a fair share in the saving that could be made by joint effort to reduce costs," the bulletin asserts. "Some amazing results could be accomplished if workers were given week by week cost records, so they could see the results of their efforts, and management agreed to share the savings with them . . .", the union's economists state.

The AFL looks for good business during the first half of 1950, with a decline likely in the second half. It expects unemployment, now at 3.4 million, to average about 5-million.

This is the advice the AFL sent out on the earnings outlook for 1950 in selected industries:

Automobiles — "Continued large profits are looked for in 1950, although some downtrend in sales and earnings is expected. Earnings of most truck and bus specialists will be unfavorable in 1949, but some recovery is expected in 1950."

Drop in Auto Parts Earnings

Auto parts—"Earnings for most companies for 1949 will decline from the exceptional 1948 level. However, compared with other years, results will still be excellent. The year 1950 is expected to witness a decline trend in sales and profits, but should still be favorable measured by the years prior to 1948 and 1949."

Metal fabricating — "Earnings for 1949 will be down sharply reflecting a drop in sales, narrower margins, and inventory losses. More stable profit net is expected in the first half of 1950 due to improved rate of shipments."

WAA Ends; Most Of Surplus Sold

WASHINGTON — The War Assets Administration, which was handed $27,200,000,000 worth of war surplus property to sell or dispose of following the late war, went out of business Jan. 1.

Since it set up shop in 1946, WAA had sold $15.3 billion (acquisition cost) worth of surplus, ranging from bombers to playing cards. Actual dollar return on this amounted to $4.2 billion, or about 27¢ on the dollar.

An additional $10.5 billion (cost value) in surplus was transferred to other government agencies or given to various institutions. The remaining $1.4 billion worth of material, mainly indurtrial plants and real estate, is yet to be disposed of. Disposal of this material will be handled by the General Services Administration through a new liquidation service.

Remaining in inventory are 29 industrial plants, including ship and engine facilities, a casungs plant, a rubber plant, a distillery, a gasoline refinery, and a magnesium smelting facility. Also in inventory are 36 pieces of non-industrial real estate, including several landing strips, and other land, some of which has buildings standing on it. An inventory of $200,000,000 worth of surplus aircraft components (parts, engines, radio and electronic gear) will have been disposed of by Jan. 31.

Studebaker Corp. Sells Its Sheet Steel Mill

SOUTH BEND, Ind.—Empire Steel Co. of Mansfield, Ohio, a sheet steel subsidiary wholly-owned by Studebaker Corp. since Jan. 1, 1948, has sold its principal assets, including plant and equipment, to the Rema Co. of Dover, Ohio, a new company organized to carry on the operations of the Empire plant.

Transfer of the sheet steel mill property was made as of Dec. 31. According to H. S. Vance, chairman and president of Studebaker, it is expected that the sale would push Empire's total assets, including cash received from Rema, considerably beyond Studebaker's original investment.

West Coast Job Shop Work Down

LOS ANGELES—A spot check of small to medium sized job shops in the Los Angeles area has revealed that 95% of their orders are of a strictly local nature—emanating from West Coast sources.

Business in general, the shops reported, is down from 25 to 33%, the shops hardest hit being those who were dependent upon aircraft orders. The aircraft industry has curtailed many of its outside jobs, preferring to do its own machining wherever possible.

Competition is tight. One shop manager put it this way: "Customers used to shop around only five or six places; now they get bids from 10 to 12 places."

Roy M. Brown, general vice-president of the IAM said that Local 311, which has jurisdiction over the some 160 machine shops doing general jobbing in the Los Angeles area, reports 10% unemployment among its membership.

This figure comes from the union's unemployment stamp system. To apply for IAM unemployment benefits, a member must be unemployed the greater portion of a month.

Shops Off 25-33%

Brown reported that local shops "are at least off 25 to 33% but many are off better than 50% over the same period last year."

He blamed unemployment among machinists in his local partly upon curtailment of shipyard activity.

Of the machine shops queried, only about 15% were doing any work from eastern firms. Almost all agreed that "the going is pretty tough."

One concern which based its business on oil tool production is off, "more than 30%."

Almost all agreed that business has declined more during the last three months than earlier in the year, despite national trends in other lines to the contrary.

The survey showed that the shops in best condition were those who beside general jobbing manufacture some item either under their own name or for a larger manufacturer. Several concerns admitted that were it not for these items "we'd be out of business."

General opinion among those shops surveyed was that the figure of failures "is higher than you'd believe." There are, however, no sustaining figures.

On the other hand, about 25% of the shops queried were optimistic and blamed slow-downs during the past three months on usual seasonal trends. Most said, however, that there were more prospective customers "waiting until after the first of the year" than at this time last year.

What will happen "after the first of the year" was anybody's guess.

As far as prospects for eastern orders, most of the small to medium shops saw little chance of eastern business. Most said competition and rail rates ruled eastern orders out except for occasional specialized work. Several of the shops queried were machining parts for manufactured items sold nation-wide—but these orders came almost exclusively from West Coast manufacturers.

Westinghouse to Boost Appliance Output; Sees 1950 Better Than '49

PITTSBURGH—Westinghouse Electric Corp.'s output of electric appliances will be increased about 15% during the first quarter of 1950, according to President Gwilym A. Price, to boost inventories which are below normal for this time of year, largely due to a sharp pickup in demand in recent months and strike-caused steel shortages.

In his year-end statement, Mr. Price said that production of consumers' durable goods is at least 50% ahead of the 1935-39 average. Semi-durable goods production is ahead about 35% and capital goods production is nearly double the 1935-39 average.

Pointing to the construction industry, he said "estimates now are that there will be some $18 billion of new construction in 1950, approximately the same as for 1949. This, incidentally, indicates the need for approximately $750 million worth of electrical building supplies and equipment, about one-third of which will be used in residential, commercial and other small types of building units."

In television receivers, Mr. Price said the output of all manufacturers in 1949 has been well over 2 million, as compared with 950,000 in 1948 and 185,000 in 1947. He predicted that "television receiver production in 1950 may well exceed 3,500,000 sets."

Here's the outlook by divisions in other Westinghouse operations:

Electronics & X-Ray — 1950 net sales billed will be twice that of 1949, due largely to increased government orders for radar, communications, and allied electronic equipment. 1949 net sales billed were 16% greater than in 1948.

Transformer Division—1950 output will be off about 10% from 1949, which stood about same as 1948 in volume of business done.

Sturtevant Division — Anticipated bookings for 1950 equivalent of 1949 volume, which was about same as 1948.

Lamp Division—Forecast for 1950 slightly higher than 1949 sales, which were slightly higher than 1948.

Elevator Division — 1950 volume about equal to 1949, which exceeded 1948 by some 13% in orders booked.

Motors Demand Uniform

Buffalo operations (electric motors and generators, 1 hp to 200 hp)—1949 production was about 85% of 1948. This rate should continue through 1950. Demand for all ratings expected to hold uniform during year.

Apparatus built at East Pittsburgh—Shipment during 1949 about same as 1948. "Should business continue throughout the year at the current level, 1950 shipments will approximate those for 1949."

Small Motor Division—Volume in 1950 about the same as 1949, when total sales billed were about 75% of 1948. "Orders now on the books promise a very satisfactory first quarter."

Electric Truck Group Elects Officers for 1950

PHILADELPHIA — M. W. Heinritz, vice president, Gould Storage Battery Corp., Trenton, N. J., has been elected president of the Electrical Industrial Truck Association. W. A. Meddick, vice president and sales manager of Elwell Parker Electric Co., Cleveland, was elected vice president.

BODY SECTION *of assembly line shows last of Studebakers, for a while. Import of American cars into India now is prohibited, and this section will be shifted over to British auto bodies and to work on trucks. Top right photo shows, across background, a battery of ten Herbert capstan lathes. In photo to right, operator works midst the battery of six Cincinnati universal millers*

Indian Plant Makes Car Parts

CALCUTTA, India (McGraw-Hill World News)—With more than $6,300,000 already invested in plant and machinery, the Hindustan Motors, Ltd. works at Uttrapara, Calcutta suburb, is the greatest automotive production center in non-Soviet Asia.

The plant differs from India's other auto plants, some of which are outright assemblers and others are producers of only a few components. Hindustan was started from the ground up with the intention of manufacturing a complete automobile, although this goal was to be reached in stages.

The last year has seen equipment installed to machine all the major components for engine, gearbox, rear axle and front suspension plus a wide range of minor parts. Its present capacity is claimed to be equal to 70% of such parts imported into India for assembly.

Hindustan Motors, a part of the Birla Brothers, Ltd. industrial empire, has license and know-how agreements with Studebaker and Morris. It assembles a slightly modified version of the Morris 10 hp under the name "Hindustan 10." Work is just winding up on assembly of Studebaker cars, as a result of India's new ban on import of dollar area passenger vehicles, but assembly of Studebaker trucks (and manufacture of most of their components) is gathering greater speed.

French Machine Tool Production Leveling Off; Sales Are Slow

PARIS (McGraw-Hill World News)—Production of machine tools in France, on the upgrade since the end of the war, is now leveling off. Sales are slow, and retailers of standard apparatus such as lathes, milling machines, drills and rectifiers are apt to be overstocked. Governmental delays in according export licenses are also hampering sales. No firms have closed down so far, but some have been obliged to cut working hours.

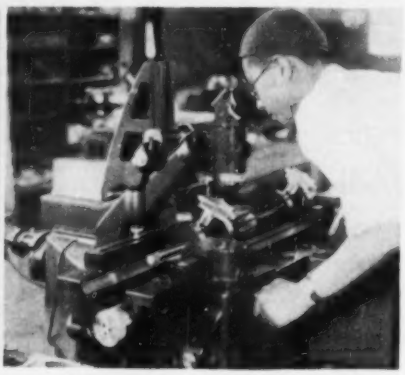
On the other hand, the French government has undertaken to free 50% of imports of machine tools under the OEEC program. Since approximately 20 billion francs worth of machine tools were imported into France in 1948, about 10 billion will now be imported without restriction. Concerned by the growing threat of foreign competition, the Syndicat Général des Industries Mécaniques (Machinists' Union) is working out proposals to submit to the government. They will probably advocate the British method, i.e., complete freedom of trade with non-competing countries, and a more careful policy toward competing countries such as Belgium, Great Britain, Italy and Switzerland.

The following table will give a clearer picture of the outlook for the French machine tool industry. Figures, as quoted by OEEC officials, are in thousands of dollars, 1948 value:

	— 1947 —			— 1952/53 —		
	Production	*Import*	*Export*	*Production*	*Import*	*Export*
Rectifiers	3,960	5,510	115	4,475	3,600	950
Boring & milling machines	3,500	3,850	30	4,300	1,400	1,260
Lathes	10,200	3,000	400	13,000	1,000	2,300
Planers	1,170	810	12	2,000	600	400
Automatic lathes	1,170	4,550	51	2,400	2,500	500
Gear-cutting machines	790	2,170	18	1,180	1,800	200
Total:	20,790	19,890	656	27,630	10,900	5,610
% of 1947	—	—	—	132	55	860

All machines are active in this lathe department bay . . . And in this modernly equipped milling department

The erecting shop of Tsugami Manufacturing Co., Ltd.



Here a Japanese technician inspects a hob

Important Machine Tool Firm Built from Small Gage Shop

TOKYO—Beginning as a small gage-making shop something over twenty years ago, the Tsugami Manufacturing Co., Ltd., of Minato-Ku, Tokyo, has grown until it now manufactures a line of precision machine tools as well as gages. Also made are inspection instruments, including microscopic devices and the lenses for these, as well as a line of sewing machines.

Among the machine tools built by Tsugami are bench type grinding machines, hydraulic universal cylindrical grinding machines, thread milling machines which include the planetary type, thread rolling and thread grinding machines, and automatic screw machines of the Brown & Sharpe type.

Smaller products made include adjustable thread-limit gages, ground taps, multiple-thread hobs, die-head chasers, rolls for thread-rolling machines, toolmakers' microscopes, microscopes for use on thread-grinding machines, bench measuring machines, optical flats, sine bars, gage blocks for size measurement and with angular ends.

Some 1500 workers are employed at the present time. The company has an apprentice training course set up along the lines of some of the best known plants in the United States.

Work done in this materials testing laboratory contributes to the good reputation Tsugami enjoys as an important Japanese machine tool builder

Its Now Easier to Forecast Sales

WASHINGTON—The Dept. of Commerce gave businessmen a Christmas present last week—a rebuilt "new orders" series that's just dandy for forecasting sales trends.

Of course, the Department has been compiling these kinds of figures for years. But up to now the series has been published in a form that wasn't very useful. Hereafter, marketing men should find it as handy as an extra right arm.

Offhand, you would say that the revisions don't seem very significant. Here's all that the Commerce statisticians did:

1. They changed new orders from an index (which presented changes as percentages) to a dollar series.

2. They adjusted the figures to take into account the selling costs and service charges that always alter catalog prices.

The net result: A monthly new order series that is directly comparable with Commerce figures on manufacturers' sales.

Sensitive Business Barometer

Graph the two series—sales and orders—as AMERICAN MACHINIST has done in Gaging Metalworking on page 81—and you have as sensitive a business barometer as it is possible to get. For any specific industry the chart will clearly show that any turndown (or turn-up) in sales is usually preceded by a similar change in the orders trend.

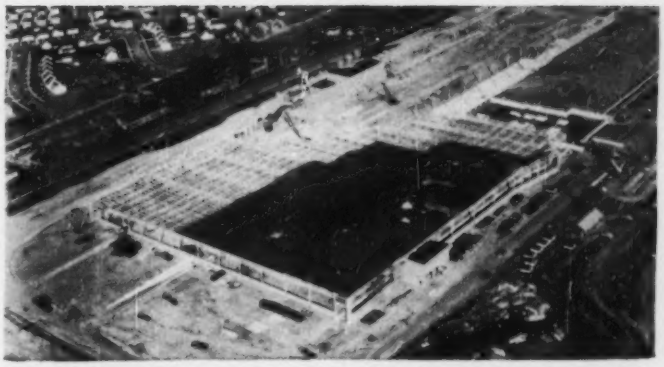
The lag can be two or three months or even longer. It varies roughly with the length of time it takes to build the product; thus, it's longer in the case of a generator than a washing machine. But long or short, it usually gives manufacturers' enough time to adjust production accordingly.

Nothing Magical

There's really nothing magical about the way orders forecast sales. Obviously, orders and sales are two sides of the same coin: you won't ring up a sale tomorrow unless someone has said he wants to buy today.

And, of course, you have your own new orders figures. But that doesn't mean the Commerce Dept. barometer is just a fancy way of saying something that's true though trite.

But in order to schedule production you have to know how your competitors' orders are running. Put another way: you want to know if the change in the trend of your own figures is the real thing or is it just a fluke that will work itself out. To be able to tell, you need more data than your own order books can give you.



LINCOLN ELECTRIC *Company's new 20-acre plant at Euclid, Ohio, has been termed a production engineer's dream. Photo shows the welded structural steel framework for the west end of the building complete and floor beams in place along the full length of the 1427-ft service corridor. It cost the company approximately $80,000 to set up a complete mock-up of production lines to be installed at the new plant, but this mock-up has already paid for itself twice over. Direct labor costs were reduced about 10% in 1948 and another 10% in 1949 as a result of these steps, most of which have been met by complete re-arrangement of materials storage and production sequences which are now integrated in conveyorized production lines. In some instances, where a single machine has been performing work on products for two separate production lines and had ample capacity to handle this volume, a second machine was installed in order to handle all operations on both productions "in line." Overhead handling in the new plant will save 20% on floor space required for the operation. Building construction is being supervised by the Austin Company*

CAA Sponsorship of Aircraft Production Urged by Boeing Executive

SEATTLE—Elaborating on the recommendation of the Aircraft Industries Association that "an existing government agency" be made responsible for "purchase of prototypes of advanced type aircraft" such as jet transports, Wellwood E. Beall, Boeing Airplane Co. vice-president for engineering and sales, proposes that the Civil Aeronautics Administration be the agency. The AIA statement did not name an agency.

Beall also goes beyond the AIA in urging that the CAA sponsor not only construction of prototypes but also production aircraft which it subsequently would lease to America's scheduled airlines. Such a plan could be administered without major new legislation or the creation of new government agencies and with a minimum of expense, Beall said. If adopted, it "would give United States manufacturers and airlines the answer to the problem of how to effectively compete with the threat of British domination of future air transportation," he asserted, in that "it offers a practical solution to the problems of financing, testing and producing jet airplanes."

Beall proposes that the CAA conduct design competitions among U.S. manufacturers for various jet transport types. Two companies in each category would be paid for construction of prototypes. After certification, the CAA would purchase production aircraft and lease them on a basis of revenue-ton-miles actually flown.

"Such a program seems to be within the scope of the Air Commerce Act of 1938, necessitating only special appropriations," Beall said. Airlines desiring to buy such new airplanes outright could do so by dealing directly with the manufacturer."

The CAA leasing arrangement would combine the maximum efforts of the three interested parties—CAA, airlines and manufacturers—in seeing that efficient, practical turbine-powered transport not only are designed and built, but operated in commerce, Beall believes.

The arrangement would provide for air transportation the same help the Maritime Commission gives the shipping industry, Beall points out.

"In case of national emergency, planes built under this proposal would constitute a valuable adjunct to the regular military airlift potential," says Beall. "The military has immediate need for turbine-powered transports capable of working as a team-mate with the new, high speed jet bombers."

Detroit

AUTO MAKERS OPTIMISTIC . . . CHEVROLET SHOWS 'POWERGLIDE' TRANSMISSION . . . NASH REVEALS PROTOTYPE OF $1000 CAR WITH CONTINENTAL LINES

THE YEAR 1950 starts off in a bright blaze of optimism. Many companies are scheduling production for the first quarter at the highest rates in their histories. All expect a boom market in sales through the first half. There are no predictions beyond next summer, but nobody anticipates a severe setback.

The brimful brightness of Detroit is well illustrated by recent predictions of leading automotive writers, made at the annual press lunch of the Automobile Manufacturers Assn. These sideline experts—who listen to what the leading automotive officials say, then dilute those views with their own—made an average projection of 4,438,000 passenger cars and 964,000 trucks for United States plants alone in 1950. Coupled with Canadian production, the industry aggregate would run somewhere close to 5,650,000 jobs. This would be definitely below the record-high total of more than 6,500,000 vehicles produced in 1949, but it would be the second-best year on record, surpassing 1929 by a minor margin.

1950 High-Production Factors

What will hold volume so high? Here are the factors:

(1) About half of the cars and trucks on the road today are still prewar vintage, need replacement.

(2) Thanks to the output-slowing effects of the steel strike late in 1949, dealer field stocks are whittled down to abnormally low levels for this time of year, creating the need for filling distribution pipe-lines during the customarily quiet winter months.

(3) Prospects of broad-scale price reductions have vanished in the granting of industry pension plans, although there have been some downward readjustments in General Motors quotations. (Buick and Olds have dropped prices on some models from $65 to $76; on special jobs, like station wagons and hard-top convertibles, the reductions are materially larger; they were evidently put through as a result of tooling amortization savings and desire to bring prices between lines into more normal adjustment with each other).

(4) Credit terms have still not gotten back to prewar standards of liberality; and credit buying is still not as widespread as before the war —two sales weapons not yet brought fully into play.

Absorb Added Steel Costs

Pricewise, it should be added that shortly after increases were announced by steel mills, a trickle of salesmen began appearing at purchasing departments with the doleful news that their quotations were going up. The car makers seemed disposed to absorb these added costs inside present profit margins for the time being, as evidenced by the Buick and Olds actions.

To tempt buyer appetites, 1950 models of virtually all manufacturers have now reached the market. Generally the changes from 1949 have been minor. One real item of note is the Chevrolet "Powerglide" automatic transmission, first time that a mechanism of this sort has appeared in the lower priced field.

This transmission is of the torque converter type, hydraulically controlled. A set of planetary gears is included for reverse and emergency low. In design it is similar to the Buick Dynaflow—comprising a primary pump, a turbine, and a secondary pump consisting of two stators which multiply thrust under heavy load.

Nash has given the auto industry two fillips of significance in the past several days. First it confirmed earlier reports that it would produce a car in "a new price class" for announcement during the spring. Presumably this will be intended to compete in the Ford-Chevrolet-Plymouth price area.

$1000 Nash Unveiled

Second, and more dramatic, on Jan. 4 it unveiled in New York a prototype of a car which could be sold at approximately $1,000. As yet there is no plan for production—and there may not be. The prototype is a creature of the engineering department, set to work to determine precisely what might be turned out in a price class which has been the subject of so much discussion of late.

The car design is of continental lines, and might—if it ever reached production stage—be powered with a European engine. It is a roomy roadster type, seating two. Styling is definitely modern and interesting.

Companies producing dies can now hope that reaction to the new car will be excellent. If it is, Nash might embark on a manufacturing program of major interest in a brand-new sphere.

***THE AIRWAY** "vicinity" car in $500-$686 price range has been developed by T. P. Hall Engineering Corp., San Diego. Powered by 10 hp air-cooled aluminum engine rubber-mounted in rear, car runs 45 mph, gets 45 miles per gallon, seats three. Designed with minimum compound curvature in body, car can be built with limited sheet metal and machine shop tools. Plastic body sections will be formed over Hall-built fixtures. Car is 158 in. long, 58 in. wide, with "step down" design. It has no clutch pedal. Transmission is connected to engine through twin-disc fluid drive. Transmission is geared to a chain which drives both rear wheels. A sprocket, attached to the left rear wheel, is connected through a conical friction differential and a shaft to the right rear wheel. Hall, who developed the Consolidated Vultee flying car, which involved an expensive and unsatisfactory automobile, decided to build this cheap auto first and then adapt it to flying. Airway Motors, Inc. is the firm's production subsidiary*

Names in the News

Clarence Snyder

Clarence Snyder, founder and chairman of the board of Snyder Tool & Engineering Co., Detroit, and **William Vollmer** and **Alvin Odgers,** the company's first employees, were presented with 25-year service pins at the company's Silver Jubilee and annual Snyder Family Party Dec. 17.

Robert W. Persons has been named product sales manager of Drill Steel Div., Crucible Steel Co. of America, New York.

Robert G. Holmes has been named branch manager of the Chicago sales office of Morse Chain Co. Div. of Borg-Warner Corp., Chicago.

John M. Scott has been named head of the die engineering and maintenance dept. of Studebaker Corp. **Arthur H. Eulitz** has been appointed his assistant. Mr. Scott has been associated with a number of automobile firms in Detroit and during the war served as general superintendent for one of the large military tank producers. Mr. Eulitz joined Studebaker in 1914 as a die maker and has spent most of his career with the company in its die engineering dept.

Robert A. Anderson has been named vice president and works manager of the Ingersoll Steel Div. of Borg-Warner Corp., Chicago. During the war Mr. Anderson headed the Procurement Div. for Borg-Warner's amphibian tank program.

Donald W. Wilson has been named general sales manager of H. A. Wilson Co., Newark, N. J. He was formerly Detroit district manager.

J. Edward Goss, industrial activities administrator of Brown & Sharpe Mfg. Co., Providence, R. I., has been reappointed to the chairmanship of the Apprentice Training Standards Committee of National Machine Tool Builders' Assn.

Bruce S. Williams, formerly manager, southeast territory, Belting Div., Russell Mfg. Co., Middletown, Conn., has been appointed assistant to the president.

Paul L. McCulloch, Jr. has been transferred to the Pittsburgh district sales office of American Brake Shoe Co., New York. He will serve as sales engineer for the American Manganese Steel and Electro-Alloys Divisions of the company, replacing **M. A. Zeller,** resigned.

Miss M. A. Caffrey, secretary, E. Horton & Son Co., Windsor Locks, Conn., is celebrating her 25th year with the company and 17th year as an officer. She was made secretary in 1932.

A. R. Edwards, E. J. Goldschmidt, Jr., and **John Molloy** have been elected vice presidents of Armco International Corp., Middletown, Ohio.

Robert T. Pring has been named technical director of the Dust & Fume Div., American Wheelabrator & Equipment Corp., Mishawaka, Ind.

Frank H. Bishop

Frank H. Bishop has been named assistant to the president of Allied Products Corp., Detroit. He was with General Electric Corp. for 22 years, progressing through plant operations and managerial functions, and acted as general manager of the Lamp Parts Div. He was most recently vice president and general manager of Tungsten Mining Corp. He will devote time to coordinating Allied's manufacturing and production facilities at its four plants located in Detroit and Hillsdale, Mich.

Ernest A. Berglund has been elected vice president of Hydraulic Equipment Co., Cleveland. Before joining Hydresco, he was manager of the Hydraulics Div., Commercial Shearing & Stamping Co.

E. D. Mairs, former assistant manager at the Masena, N. Y., works of Aluminum Co. of America, has been named manager of the wire, rod and cable mill now under construction at the Vancouver Wash., works of Alcoa. **R. W. Knapp,** former melting dept. superintendent of Alcoa's Newark, Ohio, plant, will be assistant works manager.

K. W. Horsman has been named works manager, Dunnellen, N. J. Works, of Worthington Pump & Machinery Corp., succeeding **B. R. McBath,** resigned.

John M. Scott

Arthur H. Eulitz

K. W. Horsman

Fred L. Hopf has been named general manager of Dynamatic Corp., Kenosha, Wis., a subsidiary of Eaton Mfg. Co., Cleveland.

C. E. Brady has been named general sales manager, Power Tool Div., Duro Metal Products Co., Chicago.

Russell A. Stevens has been named manager of the Boston branch, Fairbanks, Morse & Co., Chicago, succeeding **V. O. Harkness** who has been named diesel sales dept. manager for the Boston area. Mr. Stevens was formerly diesel dept. manager, Los Angeles branch.

Courtney Burton has been elected to fill the vacancy, caused by the death of **Crispin Oglebay**, on the board of directors of Ferro Engineering Co., Cleveland. **Gordon F. Eaton** and **Walter M. Charman, Jr.**, have been named vice presidents.

William Rausch has been named assistant sales manager of Rapids Handling Equipment Co., Buffalo.

Joseph Gangler has been named sales and engineering representative, assigned to the Detroit territory of Snyder Tool & Engineering Co., Detroit. He was in the Master Mechanics Div. of Chrysler Corp. engineering dept. for 23 years, and was a member of the Cross Co.'s sales and engineering dept. for five years.

Russell G. Davis is a newly appointed sales executive of Chain Belt Co., Milwaukee.

Business Items

Kold-Hold Mfg. Co.'s Platecoil Div., Lansing, Mich., has named four new eastern representatives: Paul B. Huyette Co., Inc., Philadelphia; H. R. Houghton Co., Baltimore; W. B. Parsons Co., Boston; Gerald B. Duff Co., Newark, N. J.

Parker Appliance Co., Cleveland, has appointed the following distributors for Parker O-rings: Nielsen Hydraulic Equipment Co., New York; Metal Goods Corp., Dallas; Independent Rubber Co., Chicago; Irving B. Moore Co., Boston.

Butterfield Div. of Union Twist Drill Co., Derby Line, Vt., has appointed F. P. Rogers, Seattle, representative in Oregon and Washington, and Sminkey & Haas, Chicago, distributor in that area.

G. A. Gray Co., Cincinnati, has appointed C. F. Bulotti Machinery Co., San Francisco, exclusive distributor for northern California.

Westcott Chuck Co., Oneida, N. Y., has named Herman H. Hobelmann, San Francisco, district representative in California, Oregon, Washington, and in the Reno district of Nevada.

Logansport Machine Co., Inc., Logansport, Ind., has appointed William E. Summerbell Co., Washington, D. C., Washington representative.

Columbia Tool Steel Co., Chicago Heights, Ill., has named James R. Hewitt, Jr., Houston, as Texas and southwestern representative.

American Manganese Steel Div. of American Brake Shoe Co., New York, has appointed Whitehead Metal Products Co., Inc., distributor of its Amsco welding products.

Hyatt Bearings Div., General Motors Corp., Harrison, N. J., has begun work on a 125,000 sq ft extension to its second plant in nearby Clark Township.

Simonds Abrasive Co., Philadelphia, has opened a branch office and warehouse at 8829 Hubbell Ave., Detroit, and 1350 Columbia Road, Boston.

Lapointe Machine Tool Co., Hudson, Mass., has opened a new, enlarged office in Chicago at 2400 West Madison St.

Warner & Swasey Co., Cleveland, has appointed Hallidie Machinery Co., Portland, Ore., representative in Oregon in addition to its present Washington territory. Harron, Rickard & McCone Co., San Francisco, has been named representative for northern California.

Whiton Machine Co., New London, Conn., has appointed the following agents: Anderson & White Supply Co., Chicago; Standard Equipment & Supply Co., Hammond, Ind.; Jack Brewer, Los Angeles.

Williams & Hussey Machine Co., Wilton, N. H., has purchased O.K. Tool Co., Shelton, Conn., to be operated as a division of the parent company.

Hartford Special Machinery Co., Hartford, Conn., has appointed two new agents: Joseph Windheim, Rochester, N. Y., and Lloyd & Arms, Inc., Philadelphia.

Cone-Drive Gears, a division of Michigan Tool Co., Detroit, has purchased the 12th St., Traverse City, Mich., plant of Parsons Corp.

Detroit Broach Co. has appointed two new representatives: Miller-Barber Associates, New Rochelle, N. Y., and Earl W. Keir, Milwaukee.

Obituaries

Ethan Viall, 76, former AMERICAN MACHINIST editor, died Dec. 15, as noted briefly in *AM* Dec. 29. He served his machinist apprenticeship in Chicago 1893-98, and until 1908 was foreman, superintendent, and manager of various machine shops. He began writing as correspondent for *AM* and other technical magazines, and served "Machinery" 1909-11 as associate editor. He joined AMERICAN MACHINIST in 1911 as associate editor, became managing editor, and then, in 1920, editor in chief. He left to serve from 1921-22, as general manager, T. W. Minton & Co. He became editor of Motor Service Magazine, 1927-30, and had been field editor since 1937.

J. A. Schallenberg, assistant comptroller, Worthington Pump & Machinery Corp., Harrison, N. J., died Dec. 16.

Carter Stanard Cole, 53, assistant technical secretary, American Society for Testing Materials, died Nov. 17. He joined ASTM in 1944, where he was concerned largely with work in the fields of non-ferrous metals and alloys and corrosion.

William A. Harty, president of the Exolon Co., Tonawanda, N. Y., died Dec. 6.

Jesse E. Dowley, 65, president and general manager, Calvan Machine Products Corp. of Jackson, Mich., died Nov. 9. A pioneer in establishing Jackson as an automobile parts manufacturing center, he worked on the production lines of Adams Axle Co. and American Gear Co. In 1920 he organized National Machine & Tool Co. in Jackson, which he sold in 1941 and organized the Calvan corporation.

William E. O'Connor

Died Nov. 14, as reported in AM, Dec. 29, p. 108. He joined Cleveland Automatic Machine Co. in 1906, and served 40 years as a service engineer in the New York territory

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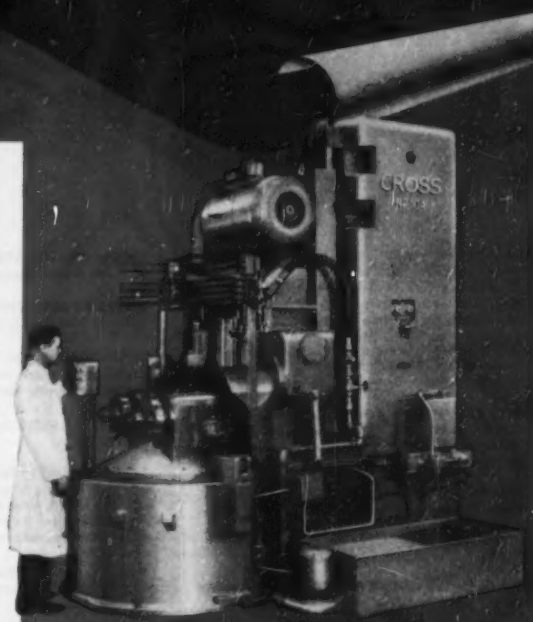
- ★ Worm gear driven cutter spindles
- ★ 450 pound flywheel for each cutter spindle
- ★ Cutting speed of 425 surface feet per minute



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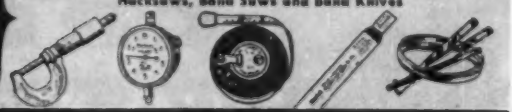


THE L. S. STARRETT CO. . . *World's Greatest Toolmakers* . ATHOL, MASSACHUSETTS . U. S. A.

Screw-Machine Work on Aluminum...I

COURTESY REYNOLDS METALS COMPANY

ALUMINUM alloys can be machined at speeds (700 sfpm or higher) and feeds equal to or in excess of those for most other metals. The greater thermal expansion of aluminum means that gaging operations must include proper attention to gaging temperature and subsequent contraction as the parts cool to room temperature. Taps and reamers should be on the high side of the tolerance range for this reason.

Adequate support to the stock is essential in maintaining close tolerances because greater deflection results from aluminum's lower modulus of elasticity.

Aluminum may tend to form light, continuous chips. To assure proper clearance, the use of hooks, chip curlers or chip breakers is often advisable.

Tool Materials and Designs

While most standard screw-machine tools are acceptable for machining aluminum, the following points should be given consideration:

To minimize metal pickup, tools should have good finish with cutting edges kept sharp. Avoid rubbing action by use of ample clearances.

High-speed steel tools are commonly used in screw-machine work because their high abrasion resistance reduces wear and "down" time for re-sharpening operations. Carbon tool steels are utilized where tool breakage presents more of a problem than tool wear, as in small fragile tools for drilling and tapping.

Cemented-carbide-tipped tools may have 30 times the life of high-speed steel tools between grinds. But the carbide tip must have adequate support, not always possible due to tool design.

Polishing tool surfaces over which the chip slides is always desirable when machining aluminum, regardless of tool material employed.

Cutoff Tools

Cutoff tools may be either circular or straight-blade tools. While a front angle of 22 to 23° will produce little burr, it may have to be reduced to as low as 8° for exceptionally deep cuts at heavy feeds. A cutting edge with two points, Fig. 1, will avoid forcing a burr into the hole when cutting off tubing.

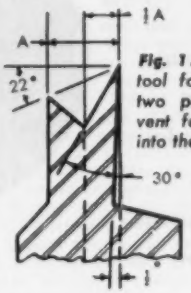


Fig. 1.. Cutting-off tool for tubing has two points to prevent forcing a burr into the hole

Circular cutoff tools obtain front clearance by setting centerline of tool ahead of centerline of stock. A ½° side clearance back of the point will reduce rubbing. Straight cutoff tools are ground with a front clearance of 8 to 12°.

Rake angles with circular cutoff tools usually include a top rake of 1 to 10°, depending upon the alloy being cut and other conditions. Straight cutoff tools employ rakes from 5 to 15°. A hook may often be desirable, ground just behind the cutting edge, Fig. 2.

Surface speeds will run around 700 sfpm for round stock, 450 and 300 sfpm for hexagonal and square stock respectively. Feeds for cutoff tools will vary from 0.003 to 0.0045-in. per rev. depending upon the alloy.

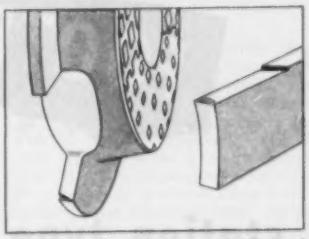


Fig. 2.. Left, circular cut-off tool with V-type chip groove; right, straight tool with chip groove ground with pencil wheel

Box Tools

Box tools permit obtaining high-quality surface finishes while removing large quantities of metal in one cut with reasonably close tolerances.

Fig. 3 shows typical box-tool blades. Tool at left has zero rake; center one has chip-curling groove; right-hand tool has chip breaker. Tool angles employed may provide clearance of 8°, cutting angle about 82°, with zero top rake unless used with a V-shaped

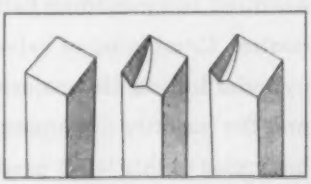


Fig. 3.. Box tool designs: left-, zero rake; center-, chip curling groove; right-, chip-breaker groove

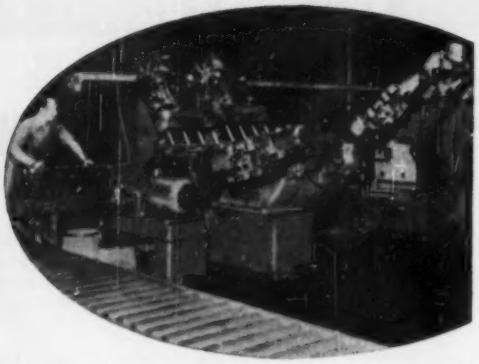
Table I ... Suggested Cutoff Tool Widths

Cut Depth In.	CUTOFF ONLY Rounds In.	CUTOFF ONLY Square or Hex. In.	COMBINED FORM & CUTOFF Rounds In.	COMBINED FORM & CUTOFF Square or Hex. In.
0.0 -0.125	0.047	0.062	0.047	0.047
0.126-0.1875	0.062	0.093	0.047	0.062
0.188-0.312	0.093	0.125	0.062	0.093
0.313-0.500	0.125	0.187	0.093	0.125
0.501-0.687	0.187	0.250	0.125	0.187
0.688-1.250	0.250	0.250	0.187	0.250

Table II ... Suggested Land Widths for Box Tools

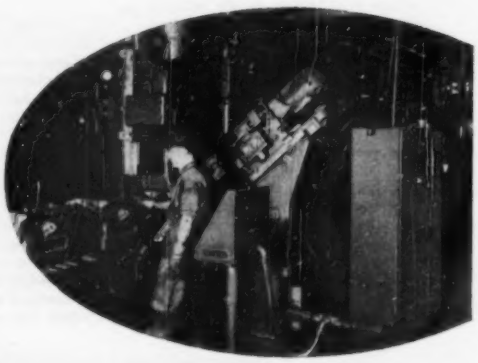
Depth of Cut In.	Feed In. per Rev.	Land Width In.
Less than 1/32	Less than 0.005	0.000-0.005
Less than 1/32	0.005-0.016	0.005-0.010
1/16	0.007-0.012	0.005-0.0125
¼	0.007-0.010	0.005-0.015
3/16	0.006-0.009	0.005-0.0175
¼	0.005-0.008	0.005-0.020

FOOTBURT



station type machines

• Production-wise engineers in leading automotive plants are specifying Footburt station type equipment on cylinder blocks and cylinder heads as the most advanced method in quantity manufacturing. Similar operations that ordinarily require several separate machines are grouped in one station machine thus greatly reducing handling and providing better production control. Combining of valve hole operation cylinder boring, the majority of drilling and the majority of tapping are outstanding examples of this latest production trend.



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Screw-Machine Work on Aluminum...II

hook as shown in Fig. 2 to provide freer cutting. Hook may provide a rake of 45 to 55° (included cutting angle of 27 to 37°).

For light cuts at low feeds, the hook may come to the cutting edge but a slight land should be left between cutting edge and hook for heavy cutting operations. Table II offers suggested land widths.

Feed used will depend on depth of cut, tolerances, and finish required. In general, feeds start at 0.006-in. for a 1/16-in. depth of cut to a finished size of 1/16 to ⅛ in., and range up to 0.015-in. for a 1/32-in. depth of cut to a finished size of ¼-in. or more.

Form Tools

Rake angles of 5 to 10° are common, although they may be used down to zero. While large rake angles promote free cutting, a large rake may bring the cutting edge of the larger diameter too far below center, when several diameters are cut simultaneously. For roughing operations or when working the softer and more gummy alloys such as 2S and 52S, additional rake is often obtained by grinding in a hook back of the cutting edge.

Chamfering tools, and others that cut on one side only, commonly employ a 15° side rake.

Due to increased cutting force on wide form cuts, it is seldom practicable to form cut unsupported lengths greater than 2½ times the smallest form diameter.

Likewise, long form tools that cut at outer end at a distance from the collet of more than 2½ times the smallest diameter are not recommended. Stock supports should be used in such instances.

When a form tool is used alone, feeds will vary from 0.0035-in. per rev. when making cuts ⅛-¼ in. wide to only 0.0015-in. for 1-in. wide cuts. The feed varies somewhat with the alloy being cut.

Reamers

Most important feature in employing reamers is the use of a floating holder to allow the reamer to center itself properly.

Knee Tools

For rough turning of short stiff work, a tool as shown in Fig. 4 may be used. Clearance angles (*a*, *b*, and *c*) are 10-15° and rake angle (*d*) is 15-20°. Tool feeds vary from 0.020 to 0.008-in. per rev. for cuts 1/32 to ¼-in. deep.

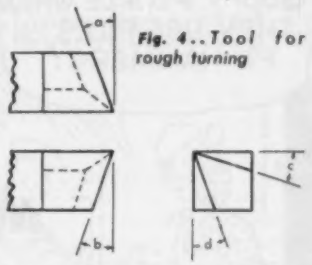


Fig. 4.. Tool for rough turning

Shaving Tools

Shaving tools may be either circular or flat. When the tool starts cutting, the rake angle is less than at end of the cut. For this reason, the rake may become negative if too great a depth of cut is attempted, making the tool cut hard.

Because the tool is moved till it becomes tangent to the work, the front clearance angle varies with diameter cut, depth of cut, and position of tool with zero clearance at end of cut. Included cutting angle is generally 85°, with ½° side clearance to prevent excessive rubbing when cutting deep flanges.

Shaving tool feeds depend upon length of cut and diameter of finished piece with 0.0005-0.0015 in. per rev. generally employed.

Skiving Tools

Skiving tools differ from shaving tools in that the front of the tool is ground with an "approach" angle so as the tool advances, only a small portion contacts the work at a time. The approach angle, see Fig. 5, is generally around 30 to 35°. A single tool may be ground with several approach angles so that the smallest diameter is turned last. A smaller approach angle may be used on large diameter work.

Included cutting angles (65 to 70°) may be used with these tools because of their method of operation and use.

Actual feeds may easily run from 0.002 to 0.012-in. per revolution.

Knurls

Knurling aluminum calls for knurls of large diameter because of the high surface speeds employed. Fig. 6 shows five types of knurl setups that work well on aluminum. Without support, Classes 1 and 2 tools are limited to a knurl length equal to the smallest stock diameter. To assure equal pressure, Class 2 setup allows the knurls to "float" up or down slightly.

Knurl teeth with an angle of 90° are commonly employed. Sharper knurls may produce excessive working of the metal.

Properly equipped knurls can operate at same stock surface speeds as other tools in the setup. Feeds are 0.020 in. for Class 4 feeding "on" (0.040 feed "off"), 0.004 in. for Class 1 and 5, 0.006 in. for swing types and Class 2, 0.0008 in. for Class 3. To avoid overworking the metal and producing a flaky knurl, allow Class 1 and 2 to dwell on the work for a short time only.

It is of utmost importance to hold nominal blank diameter within close limits (+ 0.002 — 0.003-in.).

Lubricants

Mineral oils with a viscosity of not more than 100 sec. Saybolt Universal (at 100°F) have been used satisfactorily. Soluble oils have been used.

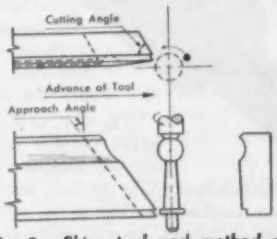
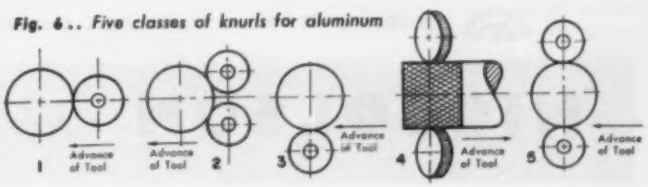


Fig. 5.. Skive tool and method of operation

Fig. 6.. Five classes of knurls for aluminum



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Electrodeposited Coatings for Metals

BY JEROME L. BLEIWEIS, Metal Finishing Consultant

Corronizing

Purpose—To provide a corrosion-resistant coating on iron, steel, and many non-ferrous metals and alloys.

Nature of Coatings—The coating consists of composite electrodeposits of nickel-zinc, nickel-tin, or nickel-cadmium.

Treatment Procedure:

1. Clean the work to be Corronized in a suitable alkaline cleaner.
2. Rinse in cold running water.
3. Pickle in a suitable acid solution.
4. Rinse in cold running water.
5. Plate with a thin coat of nickel.
6. Rinse in cold water.
7. Plate with a coat of zinc, tin, or cadmium.
8. Rinse in cold water followed by a hot rinse to facilitate drying.
9. Place the work in a heat-treating furnace for 1 to 6 hr at 500-750 F.

Notes and Comments:

1. Plating can be carried out in standard plating baths. For nickel plating, the standard white-nickel sulfate bath should be used. Zinc plating should be carried out in the acid zinc bath (zinc sulfate), tin plating in acid or alkaline baths, and cadmium in the cadmium cyanide bath.
2. During the baking period, the two plated metals mutually diffuse to form new layers of alloys of different composition.
3. The coating usually ranges from 0.0001 to 0.0004 in. thick, and is generally composed of one part of nickel to two parts of zinc, tin, or cadmium, although other compositions may be used.
4. Corronized coatings, reputedly, yield more corrosion resistance than corresponding coatings of any of the individual metals which go to make up the Corronized coating.
5. Typical Corronized coatings 0.0001 in. thick, containing one part of nickel to two of zinc, are reported to have salt-spray corrosion resistance equal to that of hot-dipped or electroplated zinc coatings more than twice as thick.
6. Corronized coatings have been twisted, bent, formed, soldered, or welded without failing or reducing their corrosion-resisting properties.
7. The process was developed by Standard Steel Spring Co., Coraopolis, Pa.

Moly-Black Process

Purpose—To produce a deep black, somewhat corrosion-resistant, coating by electrodeposition on zinc, aluminum, cadmium, tin, nickel, and iron or steel.

Nature of Coating—The coating produced is a jet-black lustrous deposit and is composed of molybdenum and nickel, probably predominantly as oxides.

Treatment Procedure:

1. Clean the work in a suitable alkaline cleaner. Vapor degreasing may precede alkaline cleaning if required.
2. Rinse in cold water.
3. Immerse for a short time in an acid pickling solution.
4. Rinse again in cold water.
5. Suspend the work from the cathode pole of a dc circuit, in the Moly-Black solution, and plate at 2 to 5 amp per sq ft for about 10 min.
6. Rinse in cold water and then in hot water to facilitate drying.

Notes and Comments:

1. The Moly-Black finish can be applied to either alloys or electrodeposits of the metals noted above.
2. Ten minutes of plating deposits a plate 0.001 in. thick.
3. The Moly-Black plating solution is operated at 165 to 170 F.
4. Throwing power of the solution is high, about 85% (5:1) by Haring cell measurement.
5. It has been reported that Moly-Black deposits over zinc or cadmium electrodeposits increase the corrosion resistance of the plated metal by 100 to 150 hr in a salt-spray cabinet.
6. A precoat of about 0.0002 in. of cadmium or zinc should be applied to all brass parts prior to the Moly-Black plating operation, to increase the corrosion resistance and prevent discoloration of the finished parts.
7. Abrasion resistance and wear of Moly-Black coatings are considerable.
8. Cost for installing an original solution for Moly-Black plating is about $1.00 per gal. Maintenance costs are about $9.56 per 1000 sq ft of surface plated.
9. The process was developed by E. I. DuPont de Nemours & Co., Wilmington, Del.

Said Mr. Hamilton* to Mr. Jones**

*Typical New Britain Sales Engineer
**Typical Industrial Executive

One New Britain 6 spindle automatic is replacing five machines in making this piece.

I only wish I could see my way clear to buy some new equipment. Some of my stuff's pretty old. What do they save on a job like that?

Well, first off they save operators. Then there's floor space and maintenance. Of course, you've got to consider the savings made on tooling and set-up of five machines against one. All in all they make the piece a lot cheaper on one automatic . . . and maintain the production rate and quality, too.

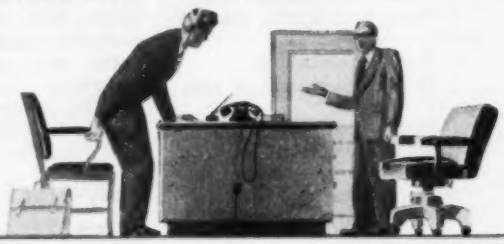
How much down-time for loading? That piece is over a foot long.

We licked that problem with an automatic, magazine-fed stock reel. It automatically loads all six spindles in less than a minute.

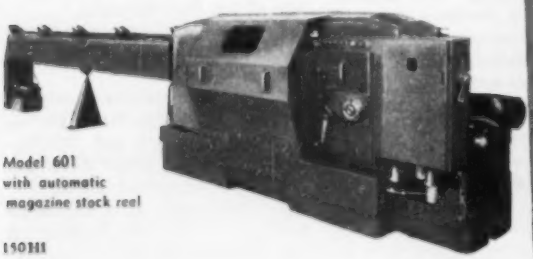
That sort of performance is impressive. I've been reading that our national average age of machines is on the way up again.

And we can't maintain the productivity we must have with over-age machines. This "modernize or die" business is no mere slogan!

What say we take a stroll through the shop right now. You might spot a job where we could save with automatic methods.



Call on your New Britain Sales Engineer to help you discover profit opportunities in metal cutting. Meanwhile, let us send you "It Can Be Done" with up-to-date cost histories on specific pieces.



Model 601 with automatic magazine stock reel

150H1

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Automatics

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NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

TALKING SHOP

Shop Radio

A. E. STALEY MFG CO now has its own radio station at Decatur, Ill. Two-way conversations are possible between maintenance headquarters and cabs of mobile cranes, fork tractors, trucks, etc., including the regular-schedule "tractor train." A dispatcher sends maintenance men to any trouble scene and handles routing of materials-handling units.

Instrumental

STANDARD OIL OF CALIF. is using the GE electron diffraction instrument to study crystalline structures of lubricant surface films. The instrument is capable of "seeing" film surfaces as thin as two millionths inch . . . The electronic micrometer is being used meanwhile in an inverted way—to measure the thickness of the "scrap" in making steel wool. Measuring the thickness of the wire section coming out of the machine gives a quick index of how well the tools are cutting, and indicates when resharpening is due.

$60 Million for Research

INDUSTRIAL RESEARCH has multiplied 25-fold in recent years, according to T. A. Boyd, GM Research Labs consultant. Present workers in engineering and research total as many as the nation's lawyers and doctors combined. Annual expenditures are about $60 million. Employers of technical personnel, he said, are looking for men who can master the roundup of scattered information and bring it to bear upon a particular problem. "This demands the ability to think independently. Progessive employers do not want the man who thinks that all knowledge has already been obtained and written down in handbooks. They are looking for the man who is good at getting new knowledge. This means that he must know and be able to use the socalled scientific method, the method of observation and experiment, which is the basis of all research," he said.

$$$ Saved

AMONG IDEAS that have saved auto makers big postwar money are these: Reduced leaks in compressed-air piping—savings, $100,000 a year. Development of a cardboard-sided, wood-base pallet for shipping to assembly plants—used once, then sold as scrap—saving, $1 million per year. Small-tool testing and research to increase tool life as much as 825%—saving $191,000 last year on one type of tool alone. Switching from rubber work gloves at $1.14 a pair and lasting one day to plastic gloves costing $0.88 and lasting three days—saving, $71,703 a year. Putting a control system on work gloves—cutting monthly glove cost from $20,000 to $14,000 per month.

Swiss Mist

TO GET RID of that fog in screw-machine and grinding rooms, the Swiss are going in heavily for American-made electrostatic precipitators. Last year, they bought more such units than did American plants.

High-Flown Stuff

BOUNCING PUTTY (silicone) is being used as a protective shell for instruments. First application is in V-2 rockets, where a ½-in. coating protects motion-picture cameras carried up—and down—to record the flight . . . GE also reports that extensive tests indicate a metal-skinned airplane is practically immune to lightning strokes, while a wood-skinned one is damaged by even minor strokes because the strokes must cut through the skin to reach the metal inside, such as control wires and engines. This cutting through is said to "disrupt violently" the skin.

Co-design

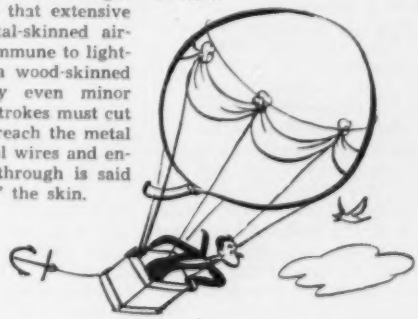
PRODUCT-DESIGN and tool engineers work together at Skilsaw, Inc., Chicago. Both groups are in the same room and report to the same man—the vice-president in charge of engineering. The claimed advantages are excellent cooperation, tooling that works when it gets into the shop, and design adjusted so parts can be made on available shop equipment.

Bigger Precision

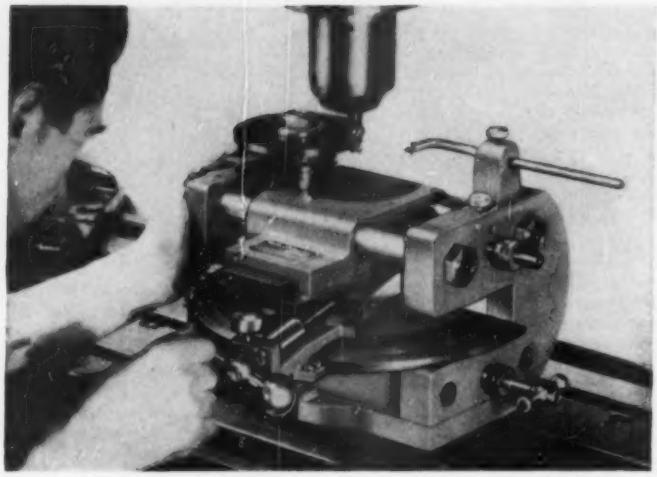
ALLIS-CHALMERS reports the 8-lb rotor and 12-lb stator for an oil-well turbo-drill have been precision cast successfully and are now in production. Each is a disk with as many as 30 integral blades . . . Currently, most of the castings are for aircraft, including some structural airframe parts . . . New investment materials give more desirable surface characteristics and greatly increased strength . . . A special injection machine for making wax patterns for jet-engine blades has been developed, as well as a batch furnace for preparing molds.

Engineers Balloon

CURRENTLY, the number of engineers is increasing 5½ times as fast as the population. Also, the number of engineers is increasing three times as fast as industry is expanding. This is statistical evidence of both the greater concentration of engineers in industry and of the increasing trend toward employing engineers in commerce—department stores, mail-order houses, banks, etc. Commercial firms now recognize the value of engineering background and point of view.



New Shop Equipment



Helix-Master mounted on a milling machine and cutting a cam directly from engineering computations

Cams Are Cut with Perfect Helix Direct from Engineering Computations

Two important improvements in cam making are claimed for the Helix-Master, a self-contained unit which can be mounted on a milling machine, grinder, or drillpress.

First, through the geometric action of three compounded slides it assures lobes with a consistent rise through every 1/100 segment with no fast or slow intervals. Thus the surface profile is generated in one continuous, sweeping motion.

Second, it will produce cams directly from engineering computations without drawings, templets, or preliminary layout. It is not necessary to have a blank stamped in 1/100ths, as these calibrations are embodied in the machine itself.

Frequently the time cycle on screw-machine operations does not work out according to estimates. In most cases this is the result of cams which do not have the perfect rises necessary to maintain optimum feeds and speeds throughout the machining cycle. High and low spots will cause breakage or premature dulling of tools, making it necessary to slow down the entire cycle.

The Helix-Master is said to eliminate these difficulties. It has the further advantage of not being geared or linked to the machine tool on which it is used. This means that it can be easily mounted and removed so that a machine need not be tied up permanently for cam production.

The drawing shows the principle of triangulation on which the machine operates. This is accomplished by three dovetailed slides, two of which form a fixed right angle, and the third of which is infinitely variable throughout 180°.

The top slide serves as the spindle carrier and moves radially on two hardened ways. The movement of this slide, which forms the base of the triangle being cut, equals the rise of the lobe being cut.

The vertical side of the triangle is formed by a cross-slide dovetailed at a fixed right angle to the spindle carrier. This slide has a rack cut along one edge which engages the spindle drive gear in a one-to-one ratio. Any linear motion transmitted to this slide rotates the spindle an equal amount. The spindle has a dial calibrated into 1/100ths of its circumference.

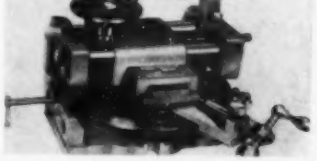
The third slide, or hypotenuse, consists of a double quadrant, or semicircular scale with an arm pivoted at its center. This scale is calibrated for direct reading in 0.001 in. rise in 1/100 of spindle circumference. Zero describes a perfect center and right or left of center gives positive or negative readings.

The arm which may be swung throughout this 180° is dovetailed its entire length. It is traversed by a shorter slide driven by a hardened and ground Acme leadscrew. This driven slide is pivoted to the rack, or cross-slide (the second slide described above).

A movement of any one of these parts sets up a series of complementary motions in all other parts. By adjusting the angular setting of the selector slide and turning the lead screw, the driven slide describes the hypotenuse of the triangle. This in turn drives the other two slides a distance in direct ratio to the angular proportions. Thus the spindle is rotated by the cross slide at the same time it is traversed radially by the carrier slide, describing a perfect helix.

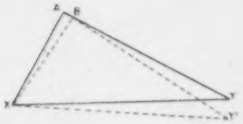
The calibrations on the quadrant were arrived at by figuring the hypotenuse, or helical angles, necessary to give any desired rise in 1/100 of spindle rotation. These are scribed in thousandths.

To cut or lay out a cam, the blank is set on the spindle with the spindle dial set at zero. If the first lobe is to



Scribing a cam from computations. It will then be rough cut and finish milled in the Helix-Master. This is the preferred method of cam production

Materials and Parts



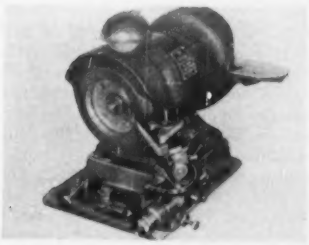
Slides operate on a triangulation principle. By shortening or lengthening XY at the same time XA is moved toward XB, a sharper or shallower arc is obtained

have a rise of 0.010 in. per 1/100 section for 12/100ths, the selector arm is set at 10, 12 divisions are spaced off on the spindle dial, and the position is locked. Feed is then accomplished by turning the leadscrew. When the first lobe is completed, settings are made for the second lobe, and so on throughout the cam.

It is possible to mill a cam directly out of the solid blank but this is undesirable because the cam must be supported only at its center and vibration is unavoidable in heavy roughing cuts. A scriber is included so that the cam can first be scribed, rough cut by any available means, and then the process repeated for a finish cut. This procedure is customary in producing cams by other methods.

Time required depends entirely on the number of operations, but should be shorter than for conventional methods because of the elimination of preliminary steps. However, the chief advantage is claimed to be the saving in screw-machine production time resulting from precision camming. It is claimed that users have been able, in many cases, to use pickup cams, and by modifying their profile, have a set of cams exactly suited to the job in a matter of minutes.

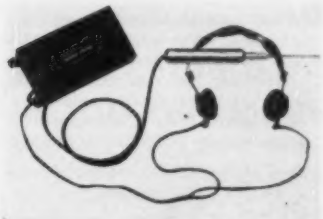
Sheffer Collet Co., Traverse City, Mich.



Adapter Base Converts Bench Grinders for Carbide Grinding

Embodying the Hager's reciprocating action, this adapter base converts almost any bench grinder into an accurate carbide-grinding machine. The reciprocating action is said to produce a straight and smooth cutting edge, prolong tool life, and the continuous motion prevents overheating of the carbide during grinding. All front, side, and top angles can be exactly set in both vertical and horizontal planes and firmly locked into position to permit trouble-free grinding. Feed knobs, graduated in 0.001-in. divisions, feed the tool towards the grinding wheel. Single-point cutting tools up to 1½ in. high can be handled by this unit. The toolholder is mounted on an arm which swivels from one side of the wheel to the other permitting grinding of both right- and left-hand tools. Any single-point cutting tools requiring exact angles can be ground on this unit.

E. F. Hager and Son, Queens Village, N. Y.



Electronic Sound Probe Amplifies, Localizes Sounds

Electronically controlled sound probe is said to localize and amplify sounds, immediately revealing their true character, whether normal or foreign. It is reported to bring out a natural reproduction of noise at the source greatly amplified without distortion.

Como-Tex Co., 128 W. Lake St., Chicago 1, Ill.

...INCLUDING

High-current welding gun attaches studs to thin finished metals without distorting the work or leaving a discernable heat mark..page 152

Billet shear of 700-ton capacity handles up to 6-in.-square work with 0.008-in. accuracy...page 153

Induction heating unit hardens cylindrical parts continuously at feed rates to 6 in. per sec. page 154

Jig driller is a four-post pump-type drill jig mounting a standard gearless drillhead with hole patterns to suit the particular part being drilled.....page 156

Hydraulic presses are tailored to meet individual specifications on die space, die opening, stroke, pressure, and number of hydraulic cylinders.....page 158

Attachment adapts any half-inch drillpress for highspeed spring making .....page 160

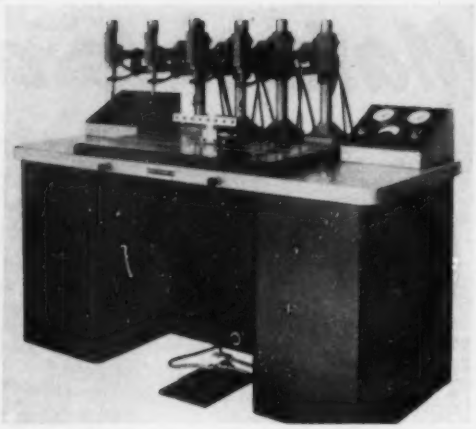
Special machine drills 18 holes on four sides and the bottom of a cast table.....page 162

Die filing machine, provides manual speed control and is said to afford 100% vertical file position at all times.....page 164

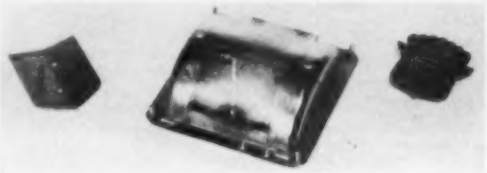
...and in Jan. 23

THE 37TH ANNUAL REVIEW... Fifteen hundred items of new shop equipment, parts, and materials, announced in 1949, are pictured and described. The review is broken down into 51 classifications for your convenience.

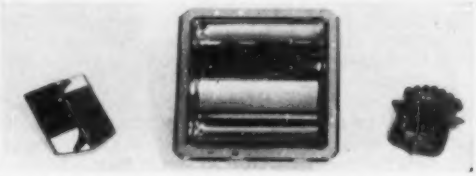
Single-gun special purpose rotary machine has an air-operated ejector for finished work and a capacity of 4000 welds per hr



Multiple-head unit provides universal mountings. Heads move transversely and can be adjusted to any angle to assure normal contact



Here are samples of stud welding on dissimilar metals



Front views of same pieces show blemish-free finished surfaces

High-Current Gun Welds Studs Without Blemishing Finished Work

Here is a high-current welding gun that attaches studs to thin metal without distorting the work or leaving a discernable heat mark. It even welds to the back of painted, enameled, or polished plated parts, without marring the finished surfaces. No flux or special cleaning of parts is required. The secret lies in the high current which passes through the arc in 1/1000 sec, ionizing the mating surfaces and cleaning them as it welds. Welding is done so quickly there is no time to heat up the surrounding parts so no fillets are formed around the weld.

No auxiliary cooling equipment is required, no timing device is needed, and the small size of the gun allows ganging up on centers as close as 1.5 in. Any standard power supply is satisfactory and the guns can be operated off a standard air supply.

The Graham welder is a capacitor-operated, self-timing device with specially tipped studs which, on coming in contact with the work, start the arc that causes ionization. This allows a path for the main discharge current of the capacitor to form an arc sufficient to melt both the full stud end and the workpiece directly under it. A simultaneous blow of the air hammer in the welder head causes the piece to weld securely.

The entire cycle is completed in approximately 1/1000 sec and movement is continuous. Work is held with foot-operated air clamp. As a safety feature both of the operator's hands are required to fire the gun. Single- and multiple-head welders are made for general applications. Single-head machines with hopper stud supply, automatic feed, and rotary indexing work table can handle up to 4000 pieces per hr.

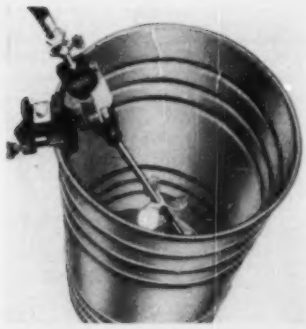
Surprising success and frequently startling economies have been reported in the welding of dissimilar metals.

Graham Mfg. Corp., Detroit, Mich.

Sprayer Unit Pumps Paint From Original Container

Air-operated paint-supply pump and agitator delivers a full supply of paint to the spray head at fluid pressures lower than are commonly used. The unit pumps directly from original containers. The Paintmaster is equipped with a positive-displacement immersion-gear pump, driven by a rotary air motor. It pumps paint, enamel, lacquer, and other finishing materials. The unit is available in two sizes; one a portable 5-gal. model, for production and maintenance painting, and the other, a 55-gal. model for supplying a circulating paint system.

Gray Co. Inc., 67 - 11th Ave., N.E., Minneapolis 13, Minn.

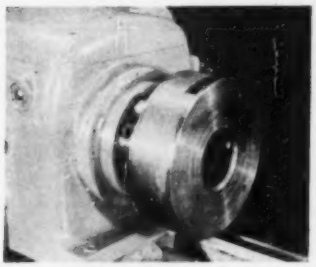


Air-Powered Mixing Motor Regulated by Needle Valve

Portable mixing motor can be clamped on the edge of drums and similar containers and can be adjusted to the desired angle with a swivel clamp. The Aro air motor, held by the clamp, is reported to be positively explosion proof and is regulated by a needle-valve adjustment for complete speed control. Motors may be selected with speeds of 500, 1200, 2800, 4500, and 17,000 rpm. Manufacturers say the Aro mixer is ideal for agitating solutions in plating tanks, in oil and water quench tanks, and in preparing drawing compounds.

Stirring rods are available in ¼- and ½-in. diameters in lengths of 12, 18, and 24 in. Aluminum propellers can be used in pairs or individually on stirring rods, and are furnished in left-hand or right-hand pitch, in standard sizes of 2¼-, 4½-, and 8-in. diameter.

The Aro Equipment Corp., Bryan, Ohio

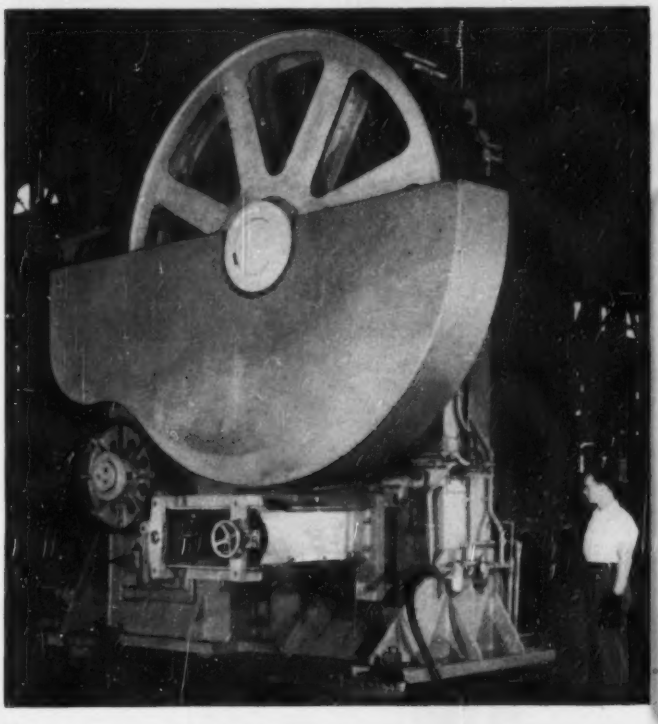


Automatic Work Driver Designed for Monarch Lathes

Work driver is equipped with serrated jaws and is recommended for in-between-center operations of all types where marking of the driving surface is permissible. It is designed for use on all Monarch lathes equipped with 6-in. D-1 or A-1 spindle nose. When the spindle is started a lever-actuated jaw clamps the work so that the heavier the cut the harder the driver pulls. If the spindle is stopped quickly, the driver opens automatically. When the spindle is stopped gradually, it is necessary for the operator to rotate the outer portion of the driver slightly, freeing the work for removal.

Standard equipment includes two sets of jaws, one of from 1- to 2¼-in. capacity and the other from 2¼- to 3½-in. capacity. Also available is a third set with a capacity from ½ to 1¼ in. The various sets of jaws are interchangeable in the body. Jaws are of the floating type and will compensate for a reasonable amount of eccentricity.

The Monarch Machine Tool Co., Sidney, Ohio



Billets Cut to 0.008-in. Accuracy In 700-Ton Bethlehem Shear

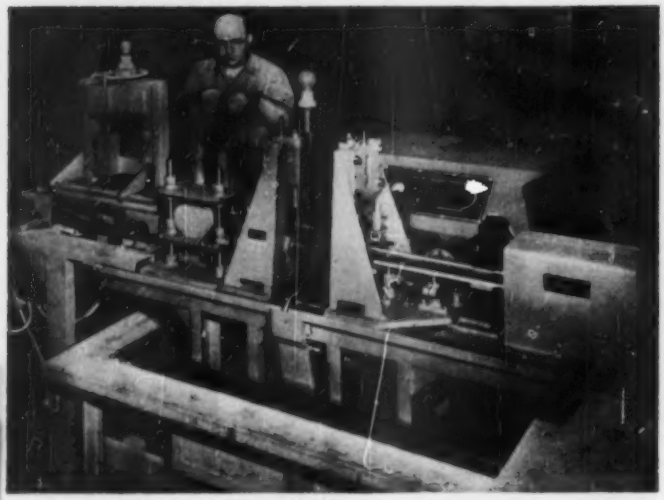
Mild-steel billets up to 6 in. square, and 105,000-psi-tensile steel billets up to 4 in. can be cut with extremely high accuracy in this shear. Two 3-in. high-tensile steel billets can be cut at once.

An air-cushioned gage facilitates positioning of work to within 0.008 in., while measuring slugs from 3 to 38 in. long. The gage is on hinges and swings out of the way providing easy access to the shear blade. Through synchronization it also retracts before the blade cuts, letting the slug drop freely. Two peels, one long and one short, are employed in the gage to reduce its over-all length.

The blade is V-notched. There is one gag roll, which is spring cushioned, to raise the billet above the V-notch in the frame after each cut. The gag roller rests on spring-cushioned brass bearings. Air balancing cylinders on top compensate for the weight of the slide, which is connected to the eccentric by the pitman, and which carries the top shear blade.

The bull gear is driven through an intermediate gear by the flywheel shaft. The shear is 13½ ft high, is powered by a V-belt drive on a 100-hp motor, and makes 15 strokes per min. Billet feed rate is 140 ft per min, by a power feed table.

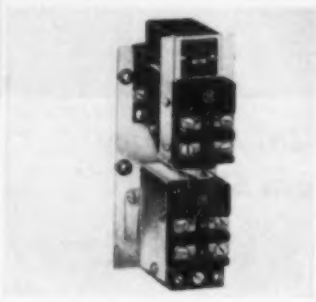
Bethlehem Steel Co., Bethlehem, Pa.



Induction Unit Hardens Parts in Desired Patterns

R-F induction equipment hardens cylindrical parts continuously at feed rates to 6 in. per sec. It consists of an automatic-loading device, a horizontal rotating scanner, and an industrial radio-frequency generator. The loader, consisting of a magazine and hopper, feeds pieces to the scanner through a feeder unit. Work is then passed through an inductor coil and spray-quench ring. Uniformity of case depth is obtained by controlled feeds and concentricity of case is assured by positive guide and rotation of the cylindrical workpiece about its longitudinal axis. By adjustment of electronic timing circuits a wide variety of cylindrical parts can be hardened in any desired hardness pattern.

Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.



Pneumatic Timing Relay Available for ac or dc

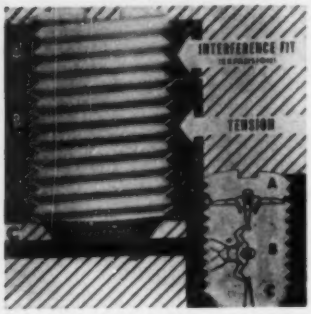
Adjustable timer, Bulletin 849, utilizes a synthetic rubber bellows for controlling the tripping time. The range is adjustable from 10 cycles to 3 min with an accuracy of ± ten percent. The relay resets instantaneously. Performance is unaffected by temperature, humidity, or vibration. The timer is available for ac or dc operation with quick-make and quick-break double pole, silver alloy contacts, one set normally opened and one set normally closed. The unit can be readily changed from on delay to off delay operation by inverting the solenoid.

Allen-Bradley Co., Milwaukee, Wis.

Broach Design Provides Increased Stock Removal

The "Whole Hog" broach-design principle is applicable to either internal or surface broaches and is said to be especially efficient when starting in a cast, pierced, or forged opening, where sand or scale may be encountered. It is intended primarily for use where stock removal is heavy and is reported effective in broaching unusually long parts. The broach contains a short section of teeth having a large number of angular splines ground lengthwise, incorporating very fast rise from tooth to tooth. The next section of the broach has plain round teeth, each being the same OD as corresponding tooth in the spline section. Increases in tool life up to 88% are said to have been obtained over other special broach designs. Whole Hog broaches have been successfully used in broaching piston-pin holes, forgings, iron castings, bar stock, and seamless steel.

Acme Broach Corp., Milan, Mich.



Self-Locking Setscrew Withstands Excessive Vibrations

The Zip-Grip self-locking setscrew and adjusting screw requires no lock nuts, wires, impinging locking screws, deformed or riveted threads, and is for applications in which excessive vibration is a factor. A combination of interference fit, tension, and locking of the setscrew against the shaft provides triple-locking action with this screw. The lower part of the Zip-Grip screw, which enters the hole first, has a standard thread, but the upper section has a larger pitch diameter of thread section creating an interference fit.

Set Screw & Mfg. Co., Bartlett, Ill.

Bent-Handle Wrenches Offer 7/8- to 2-in. Openings

Williams 45 and 90° bent-handle construction wrenches facilitate work in close quarters where maximum accessibility and leverage are required. They are available in both carbon and alloy steels in openings from 7/8 to 2 in.

J. H. Williams & Co., 40 Vulcan St., Buffalo 7, N. Y.

PULLMAN-STANDARD FINDS MANY USES FOR STEELWELD PRESS

Model LS½-10 Steelweld Press making hutch frame parts for phosphate cars. Two parts are made at one time from ½ inch plate, one for left-hand and other for right-hand of hutch. Note pins on male dies which remove parts from lower dies after forming.

A few of the many parts produced within a short period on the Steelweld Press. Curves and bends of every shape and degree are formed quickly and accurately.

"The more we use our Steelweld Bending Press, the more we learn about what it can do for us", said the Day Superintendent of Pullman-Standard Car Mfg. Co., Butler, Penna. "As a result it is handling more and more of our work. We are doing a great many forming jobs on it that did not occur to us as being possible when we first installed the machine."

An endless variety of parts are produced on this press. These are mostly of ¼ and ⅜ inch steel plate and involve curves and bends of every description for gussets, fulcrums, braces, frames, housings, etc. used in the manufacture of railroad cars.

The dies used are relatively simple and made in the company's shop. Because dies are easily changed, it usually takes about an hour to set up for a new job.

If you work with metal plate in any thickness up to one inch, for bending, forming or punching, you should get the facts on the many features of Steelweld Presses.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1430 EAST 281st STREET • WICKLIFFE, OHIO

STEELWELD

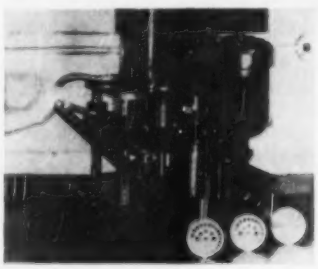
BENDING PRESSES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

Sand-Blast Helmet Equipped With Air-Supply Tube

Helmet for protection against heavy concentrations of dust and abrasives in sand-blasting operations weighs only 6 lb. A perforated tube, supplying air at the top of the helmet, eliminates need of a separate face mask. The latex-covered canvas hood is supported by headgear containing a removable soft felt skull cap, laced for adjustment to any head size. Metal supports keep the front of the helmet away from the face allowing proper ventilation.

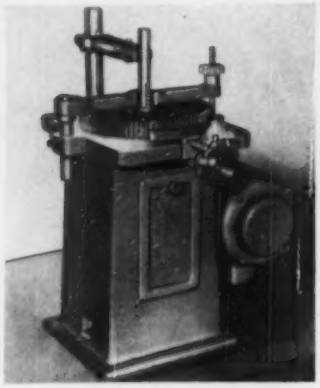
Wilson Products Inc., Reading, Pa.



Drill Jig Converted Into Drilling Machine

The Jig Driller is said to satisfy needs between standard single-spindle drilling machines and expensive special-purpose drilling machinery. It consists of a four-post pump-type drill jig mounting a standard Zagar gearless drillhead with a hole pattern to suit the part being drilled. In the middle of the jig is a bushing plate which holds the drill bushings and the locators for the parts being drilled. An operating handle feeds the part into the drills through a standard rack-and-pinion mechanism as provided in the drill jig. For some jobs this feed mechanism can be supplanted by an air or a hydraulic cylinder. The drillhead is driven through V-belts. Correct drill speeds are obtained by proper pulley ratios.

Zagar Tool Inc., 23880 Lakeland Blvd., Cleveland, Ohio



Keyseating Machine Centers, Feeds Work Automatically

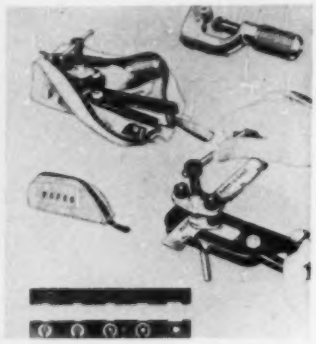
Keyways 1/16 to ½ in. in cast iron, and 1/16- to ⅜-in. steel can be cut by the No. 1 Keymatic keyseater. Centering feed to depth, relief on upstroke of cutter, and stop are all automatic and the machine uses no bushings. Stroke is 3 in., length of cut on 1/16 to ⅛ keyseats is 3 in., and length of cut on 3/16 and larger keyways is 4 in. Table size is 12 x 14 in. Change from one work size to another requires only changing the cutter bars. This is accomplished by loosening and tightening one hollow-head screw. The Keymatic is powered by a ¼-hp 1750-rpm motor with V-belt drive. Weight is 216 lb.

Keymatic Machine Co., P.O. Box 1953, Cincinnati 1, Ohio.

Interchangeable Filters Give Respirators Versatility

Through a system of interchangeable filters, these twin-cartridge respirators provide protection against seven respiratory hazards. The seven different filters protect workers against (1) a combination of all dusts, (2) organic vapors, (3) acid gases, (4) combined acids and organic gases, (5) ammonia, (6) combination of organic vapors and all dusts, and (7) metal fumes. The respirator has a flexible fitting brace for shaping it to individual features.

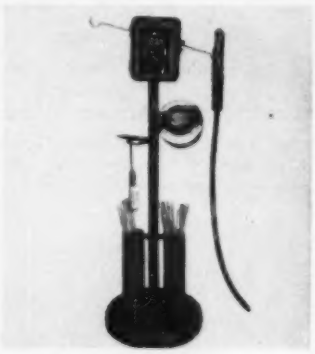
American Optical Co., Southbridge, Mass.



Tube-Flaring Kit Accommodates Five Sizes

The Form-A-Gage, included in the Papco Superior tube kit serves as a height gage for five sizes of tubing, determining the exact amount required for crimping prior to double flaring. The five sizes accommodated are 3/16-, ¼-, 5/16-, ⅜-, and ½-in. tubing. Included in the kit is the flaring punch, the gage, and a tube cutter.

Papco Tools, Penn Brass & Copper Co., Erie, Pa.



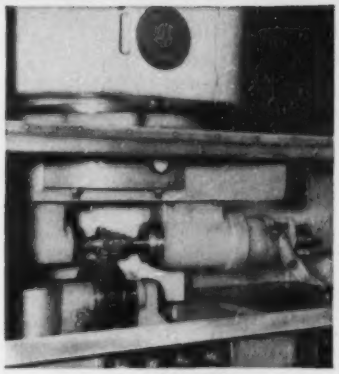
Welding-Control Switch Mounted on Stand

Stand-mounted remote start-stop switch is equipped with arms providing finger-touch control. The weight of an electrode holder breaks the circuit and shuts off the welding machine. The unit can be connected to any motor-generated welder having pushbutton starting.

Hobart Bros. Co., Troy, Ohio

CUTTING GEAR COSTS ISN'T *Difficult*

here's how one producer did it . . .

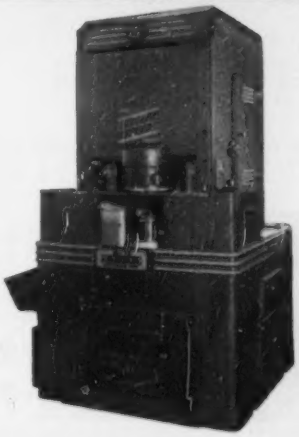


STEP NO. 2 **He reduced total cutting time and tool costs by ADDING underpass gear shaving.**

Time for hobbing plus underpass gear shaving on Michigan 870s is only 85% of previous cutting time.

Tool cost for both operations is less than for tools used previously.

STEP NO. 3 **He reduced pre-shave cutting and down-time *(and pre-shave tool costs)* with a Michigan Shear-Speed machine.**



Cutting time is now only a little over a minute per gear (heavy duty gears). Equals output of 8 to 10 other gear cutting machines.

Operator effort reduced (operator actually "works" only one hour out of eight).

Down-time for change-over for Shear-Speed is below that on previous machines for same output. 70% of gears for 3 transmission types now cut on this one machine.

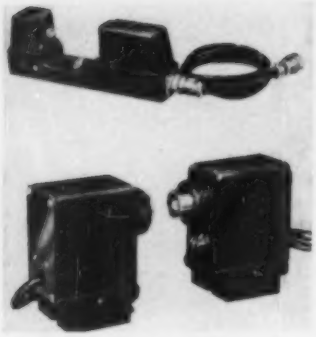
Entire cost of tools (initial and replacement) for the Shear-Speed were more than paid for by savings in sharpening time alone.

QUALITY? The complete new "Michigan" setup according to the gear producer gives him: More accurate involute and spacing (better contact); longer life; *variation off shaving machines of only plus or minus 0.0001 in.*

STEP NO. 1 *Oh yes, we should have put this first. Step No. 1 was to call in a Michigan Tool Company representative.*

COMPLETE — from blank to finished gear — EQUIPMENT

MICHIGAN TOOL COMPANY 7171 E. McNichols Road Detroit 12, U.S.A.

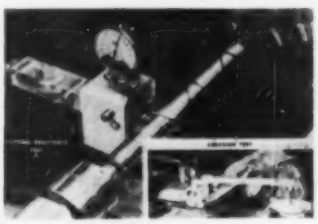


Count Detector Responds To 0.001-in. Screws

Photoelectric count detectors are completely sealed and provide the pulse output required to operate high-speed electronic counters. Model 607 is contained in two identical housings, one for the light source and the other for the photocell and amplifier. By interchanging lenses of the units, two types of photoelectric beams are available. A parallel beam of ½-in. dia can be used at distances up to 6 ft between units. The other beam is a focused ⅛-in.-dia spot obtained when the units are 6 in. apart.

In Model 608, an integral unit containing both light source detector and amplifier, a 1/16-in.-dia spot is obtained midway between light source and detector. Parts as small as 0.001 in. balance wheel screws have been counted.

Potter Instrument Co., 136-56 Roosevelt Ave., Flushing, N.Y.



Shop Unit Tests Machinability Of Ferrous, Non-Ferrous Metals

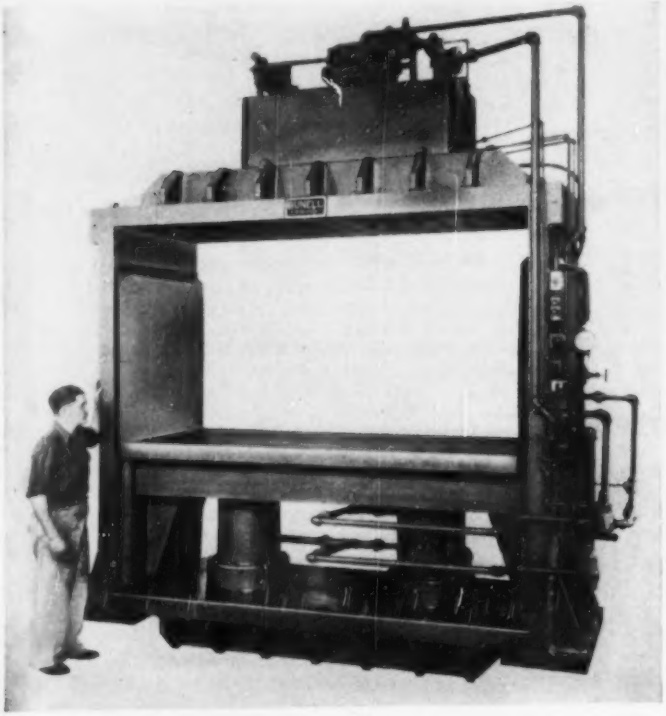
The M.S.E. Schlesinger machinability tester is said to offer a machinability index capable of development into a variable universal standard. This is done by workshop tests during cutting operations such as turning or planing. The tester measures two basic characteristics of metals. The first is specific cutting resistance exerted by a material against the penetration of a standardized cutting tool. This measurement is made for a standardized chip area with the dial indicator on the instrument reading in. lb per 0.001 sq. in. Secondly the unit measure the abrasiveness effect of the same work material on a hardened calibrator. This is done by measuring the abraded flat on a standardized 10-mm test ball brought into contact with the work material under known pressure for a given time.

Vanton Equipment Corp., Empire State Bldg., New York 1, N.Y.

Die-Sinking Cutters for High and Low Spindle Speeds

Spiral flutes and clearances of the Reltool die-sinking cutters are designed to provide maximum cutting efficiency without vibration, and to leave a smooth, clean finish. The line includes cutters for both high and low spindle speeds. Special types are made to customer's specifications.

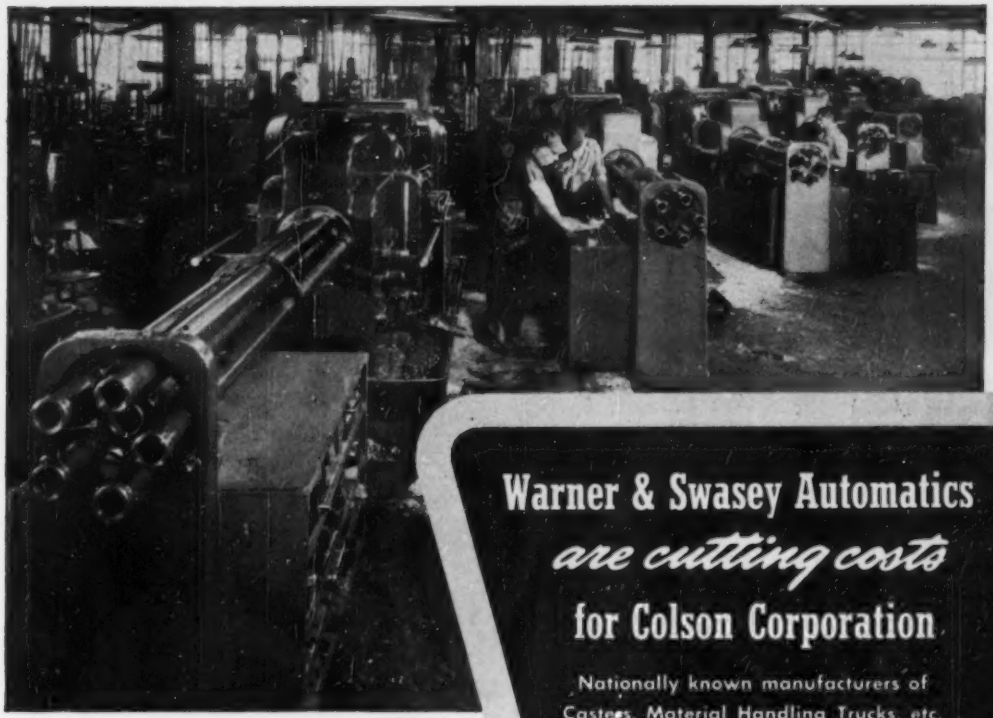
Reltool Corp., Milwaukee 3, Wis.



Bunell Hydraulic Presses Tailored to Specifications

An extremely flexible design is combined with low original and operating costs in the Bunell universal hydraulic press. Individual specifications on die space, die opening, stroke, pressure, and number of hydraulic cylinders can easily be met. Die spotting and tryout, blank development, straightening, molding, laboratory tests, steel-stamping production, and assembly under pressure are among the work which can be handled by these units. Two-way hydraulic cylinders apply pressure in either direction of the ram movement and finger-tip control regulates the final pressure. Controlled downward movement of the ram facilities stopping at any desired working height. Two slides and lack of other bearings reduce the chance of scoring the way with emery dust in die spotting operations. Long slide surfaces of the ram and adjustable gibs prevent binding due to uneven conditions in the die at the start of contact, and increases the working life of wear surfaces.

Bunell Machine and Tool Co., 1601 E. 23rd St., Cleveland 1½, Ohio



Five of seven Warner & Swasey 5-Spindle Automatic Bar Machines in operation at Colson Corporation, Elyria, Ohio.

Warner & Swasey Automatics *are cutting costs* for Colson Corporation

Nationally known manufacturers of Casters, Material Handling Trucks, etc.

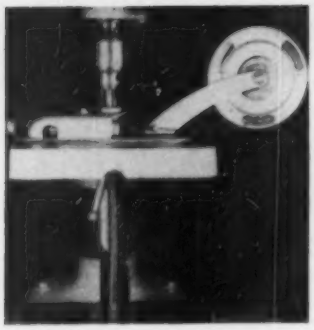
THE COLSON STORY

- ★ Setup time cut more than 50% on new Warner & Swaseys.
- ★ Production up 7 to 8 times on lots of 500 to 10,000 pieces.
- ★ "Progressive" setups are much more practical on Warner & Swaseys.
- ★ Small lots are economically practical on this new CAMLESS Automatic.
- ★ Machine operators appreciate easy access and interchangeability of tooling.
- ★ Both management and operators approve—NO CAMS TO CHANGE.
- ★ Five repeat orders prove the profitability of Warner & Swaseys.

It's simpler to set up a Warner & Swasey CAMLESS Automatic!

WARNER & SWASEY *Cleveland*

Turret Lathes, Multiple & Single Spindle Automatics, Precision Tapping and Threading Machines



Attachment Adapts Drillpresses For Spring Making

Springs may be made at high speed on any ½-in. drillpress, by use of the Spring-Master. Wire from 6 ga (0.016) to 28 ga (0.071) is handled and OD of finished springs can be varied from 3/16 to ⅝ in. Pitch of compression springs may be infinitely varied while machine is running. Spring length is governed only by length of wire used. One inexperienced operator can easily run two or more machines and no attention is required after set-up other than replacement of wire spools and studding.

Cycloid Corp., 12 Newhall Ave., Saugus, Mass.

Redraw Rod, Round-Drawn Wire Available in ⅜-in. Dia

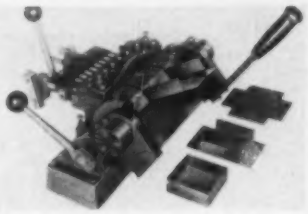
Both redraw rod and round-drawn wires are being produced in 2S, 3S, 52S, 61S, 43S and 150S aluminum alloys. Redraw rod is available in annealed and as-fabricated tempers (O and F) with standard coils weighing 220 lb. Round-drawn wire is supplied in coils and standard tempers in size ranges between 0.051 and 0.0250.

Kaiser Aluminum & Chemical Sales Inc., 1924 Broadway, Oakland 12, Calif.

Splash-Proof Motor Withstands Direct Streams of Liquids

The Sterling closed splash-proof motor may be mounted in any position and is designed for locations which are subject to direct streams of water or other liquids. End bells permit free passage of ventilating air through integrally cast baffles, preventing splashing liquids from reaching the interior of the motor. Air is drawn through the rear of the motor and exhausted through the shaft end, blowing away foreign materials, water, and other liquid from both motor and driven assembly. The unit incorporates labyrinth seals on shaft end bearings which are lubricated for life.

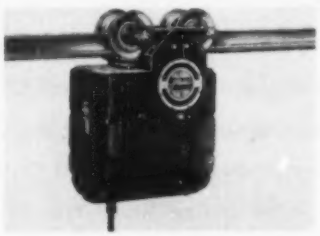
Sterling Electric Motor Inc., Los Angeles, Calif.



Box Fingers Adaptable To Di-Acro Brakes

All Di-Acro brakes, regardless of the date purchased, can be converted to precision box and pan brakes by replacing the standard solid-top bar with the Di-Acro box-finger bar. Brakes in all four sizes are available in standard or box-finger models. Box fingers can be quickly adjusted for any size box within their capacity in graduations of ⅛ in. Box forming ranges from ½ to 24 in. can be obtained.

O'Neill-Irwin Mfg. Co., 311 Eighth Ave., Lake City, Minn.



Monorail Tractor Moves 5-Ton Loads Up to 250 FPM

The Calabar fluid tractor is for propelling electric or hand hoists on monorails and cranes and is controlled by magnetic reversing contactor and pendant push-button. Equipped with either ½- or ¾-hp three-phase electric motor, operating at 1850 rpm, these units fit any track with flat or tapered tthread ranging from 2 to 5½ in. and move loads up to 5 tons forward or backward at speeds ranging from 50 to 250 fpm. It is totally inclosed in a dust-proof aluminum alloy housing.

Calabar Corp., South Gate, Calif.

Metal Disintegrator Removes Taps from 0.08 to 1 In.

Operated on any standard drillpress, the Thomas Metalmaster Junior removes broken taps from 0.08 to 1 in. and takes out any broken tools, taps, studs, reamers, pins, plug gages, and drills without distorting threads. It will cut rounds, elongateds, open squares, blind squares, hexagonal, and pinion-shaped holes in carbides or any hardened metals. Operating costs are said to be less than 5 cents per hr. Price is $147.50 F.O.B. Clinton, Mich.

Clinton Machine Co., Metalmaster Div., Clinton, Mich.

Part Demagnetizer Reduces Scoring

The Dings demagnetizer, for precision parts, provides a convenient method for overcoming dangers of chips or magnetic dirt adhering to parts and causing scoring or failure of close-tolerance machinery. The unit can operate individually or for continuous duty with rubber conveyor belt moving through the coil. There are no moving parts on the units itself. Wires are glass insulated. The magnetizer is available in three-, five-, and six-inch sizes 220 or 440 volts ac.

Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee, Wis.

end paint failures on die castings

BONDERITE

FAST • DEPENDABLE • ECONOMICAL

Die castings and paint need something *between* them to keep *them* together!

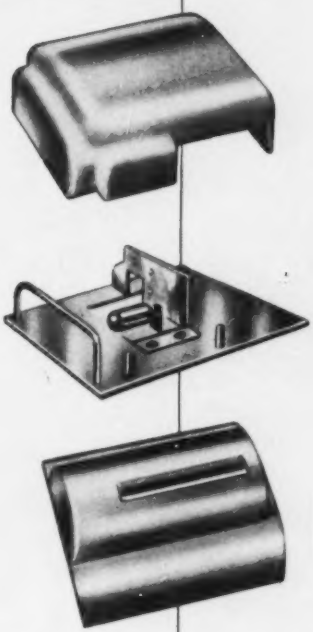
Bonderite creates a layer of nonmetallic crystals on die-cast surfaces; a layer that is part of the metal itself. Bonderite resists under film corrosion, provides a perfect anchor for paint, ends peeling and lifting of the organic finish. Bonderite-treated die castings hold their factory-created fine appearance.

Bonderite treatment prior to painting is simple and uniform in performance, effective in results, economical in cost, and fast enough to match any production line's pace.

Bonderite *your* die castings before you paint.

OUR TECHNICAL BULLETIN TELLS THE STORY

Get full information on Bonderite for die castings. Write today for *Free* technical bulletin.



Bonderite, Parco, Parco Lubrite—Reg. U. S. Pat. Off.

PARKER

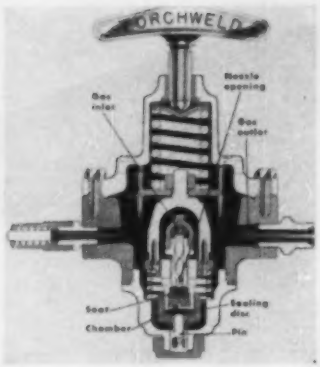
PARKER RUST PROOF COMPANY
2196 East Milwaukee Ave.
Detroit 11, Michigan

BONDERITE—Corrosion Resistant Paint Base • PARCO COMPOUND—Rust Resistant • PARCO LUBRITE—Wear Resistant for Friction Surfaces

Journal Lubricator Employs Non-Glazing Felt Wick

Old-fashioned yarn or waste packing has been eliminated on the Felpax lubricator for journals on overhead cranes and similar industrial equipment. Special non-glazing felt wicks are attached to the holders and are kept in place with the correct pressure against the axle to provide full and constant lubrication to bearings and thrust flanges. The units can be installed in three simple steps and in the way of service require only periodic checks and filling of oil reservoirs.

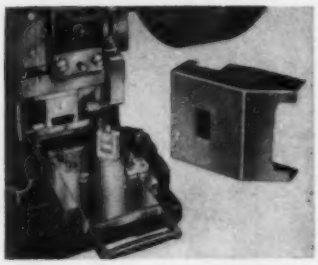
Miller-Felpax Corp., Dept. 1, Winona, Minn.



Welding, Cutting Regulator Eliminates Two-Stage Reduction

The Torch Weld, "6500" welding and cutting regulator maintains constant volume and pressure of gas without requiring two-stage reduction. It incorporates a pressure-compensating unit in the valve-seat assembly which counteracts effects of decreasing cylinder pressure. This pressure-compensating unit consists of a small gas chamber below the valve seat, a reinforced rubber sealing disk at the bottom of the chamber and a pin which rests between the disk and the back cap of the regulator. The force of gas at cylinder pressure in the chamber results in an action which moves the seat gradually away from the nozzle, as supply pressure decreases, permitting a constant rate of flow to be maintained.

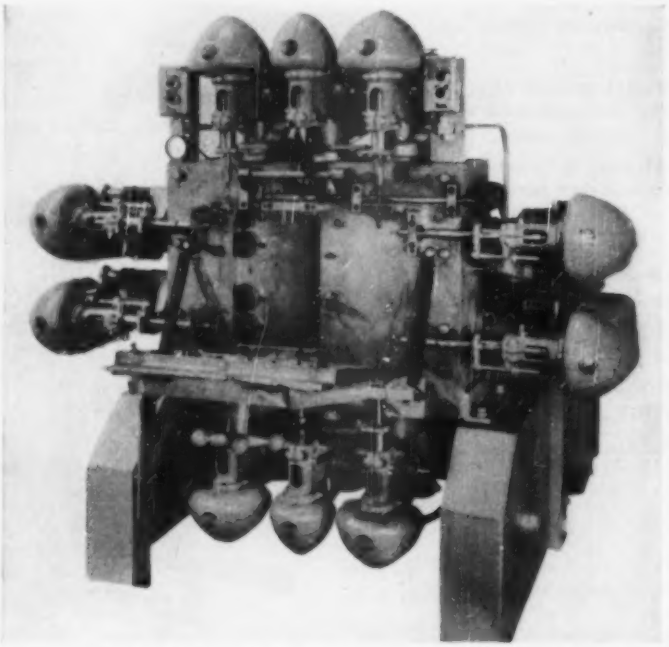
National Cylinder Gas Co., Chicago, 11, Ill.



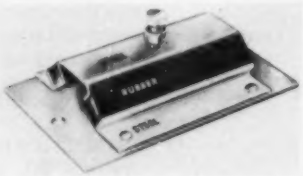
Serial Numbers, Repeat Markings Stamped Simultaneously

Mounted in a standard die set for assembly in precision power presses, this Acromark unit is equipped with a slide-style interchangeable type holder and a consecutive-action automatic numbering head. A hand slide feeds name plates or flat parts underneath the stamping assembly. Length of stroke is 1 in. and die set is 7½ in. high with 1-in. dia and 2-in.-long shank.

The Acromark Co., 7-13 Morrell St., Elizabeth 4, N.J.



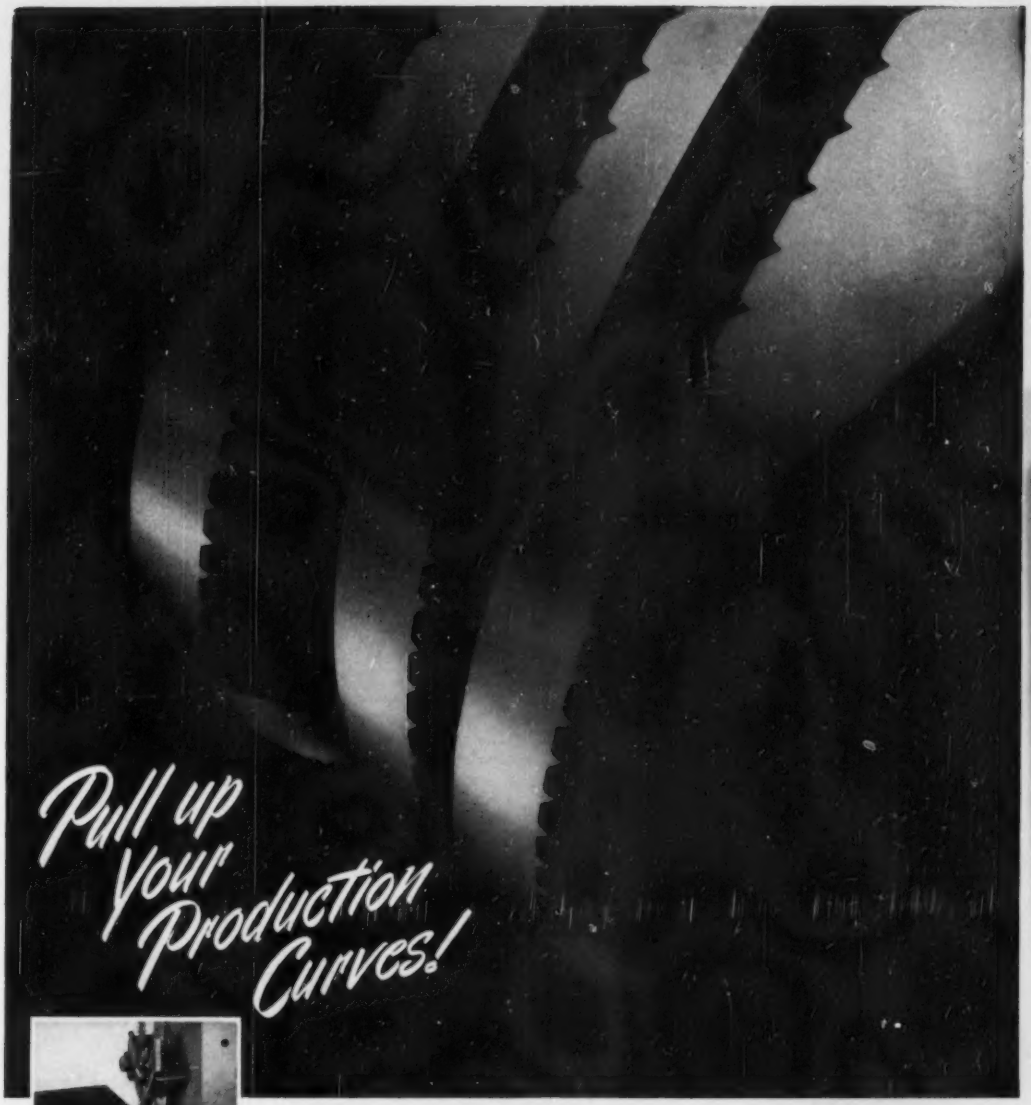
A TOTAL OF 18 HOLES are drilled on four sides and the bottom of the cast table for a new tilting-arbor saw on this special single-purpose machine. Eighteen standard Delta drilling units have been assembled in one machine to handle the production schedule required. Work is held on a heavy metal door which is closed in vertical position and latched during the operating cycle.— ***Delta Mfg. Div., Rockwell Mfg. Co., No. 600 E. Vienna Ave., Milwaukee 1, Wis.***



Vibration Isolator Adaptable To All Types of Equipment

The Finnflex SP-9 vibration isolator comes drilled, tapped, and ready for use. It consists of a steel channel floating in rubber between two steel angles, welded to a steel faceplate. The entire weight of machines bolted to the top channel of the SP-9 mount is carried by rubber in shear. Mounts are available in any length up to 30 in. and in four rubber stiffnesses for loads of 40, 50, 70, and 105 lb per in. of length at ¼ in. deflection.

Finn & Co., 2850 Eighth Ave., New York 30, N.Y.

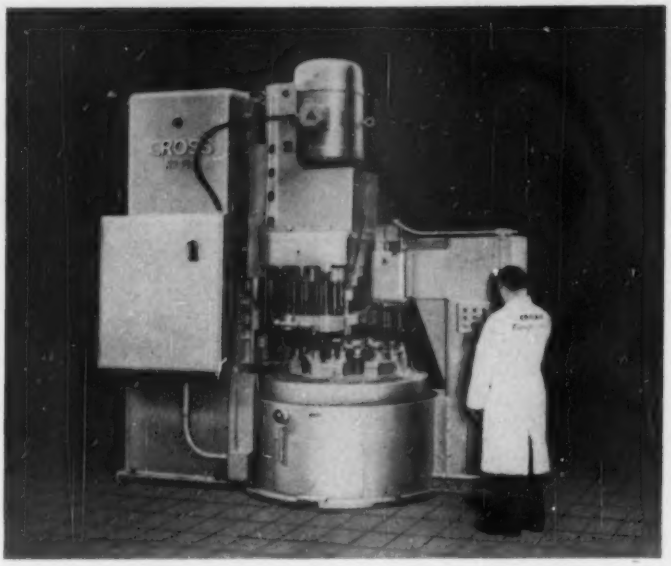


Use SIMONDS Metal-Cutting Band Saws

These tough blades start life with a steel of special analysis. The Skip-Tooth Saw shown gives outstanding performance in cutting non-ferrous metals and composition materials at high speeds and feeds. But whether your requirements are for skip-tooth or regular-tooth saws on horizontal or vertical machines, you are assured of evenly milled, perfectly shaped teeth, with heat-treatment controlled for maximum efficiency. Have your Industrial Supply Distributor recommend the right Simonds Band Saw for YOUR job. Call him today!

SIMONDS
SAW AND STEEL CO
FITCHBURG, MASS.
Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry
SIMONDS — Special Electric Furnace Steels
SIMONDS — Grinding Wheels and Grains
SIMONDS — Simonds Products for Canada

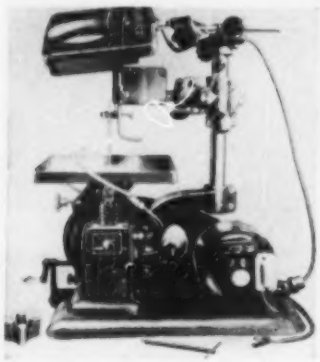
BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green Street, Chicago 7, Ill.; 416 W. Eighth Street, Los Angeles 14, Calif.; 228 First Street, San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.



Automatic-Cycle Machine Drills, Taps, Reams, and Counterbores

Planetary gear cages are drilled, tapped, reamed, and counterbored at a rate of 75 parts per hr at 100% efficiency on this Cross automatic-cycle special machine. Multiple operations on opposite sides of the part are handled simultaneously in each station by double loading. Power clamping is provided for the work-holding fixture and the index table is a six-station fluid-drive unit. One operator is required to run the machine.

The Cross Co., Detroit 7, Mich.



Die-Filing Machine Affords Manual Speed Control

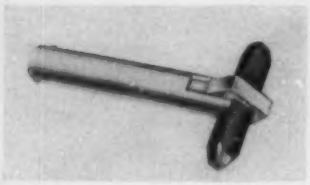
A universal-joint file clamp and file-setting square on the Model 1500-SR die-filing machine assures 100% vertical file position. Infinite speed changes within the range of 170 to 470 strokes per min are obtained with the manual speed-control device. A flexible metallic-hose chip blower can be directed at the work being filed. Sawing and honing attachments and an illuminated magnifying glass which attaches to the overarm post are available. The Scotch-yoke mechanism, which actuates the file, runs in sealed oil bath.

All American Tool & Mfg. Co., 1014 Fullerton Ave., Chicago 14, Ill.

Small Dust Collector Has 3630-cfm Capacity

Model 30N50 Dustkop develops 3630 cfm (velocity 10,400 fpm) and measures 28 x 49 in. floor space by 82 in. over-all height. A self-clearing, paddle-wheel fan direct driven by a 5-hp continuous-duty motor clears lint and strings from buffing, chips, shavings, and saw dust from woodworking operations. The unit can handle four grinding, buffing, or polishing wheels of 19- to 24-in. dia, multiple abrasive or sanding belts, or dust from conveying, packaging, and mixing. The dust-laden air enters the unit at the 8-in.-dia inlet and dust, dirt, chips, and shavings are taken out in the cyclone separator and deposit in a dust-storage compartment of 12-cu.ft capacity.

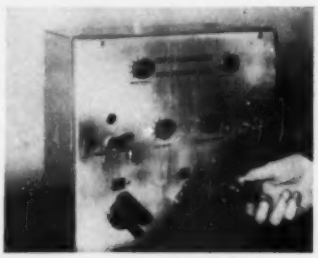
Aget-Detroit Co., Ann Arbor, Mich.



Hand Tool Holder Permits Adjustment of Head Section

The light-weight Luminum-Lined adjustable hand tool holder is designed to prevent smashed fingers in the use of steel stamps, cold chisels, drifts, and punches. Slotted head section can be pushed out and stamps changed with only first finger and thumb. Size No. 1 holder is applicable to ¼- and ½-in. tools, and size No. 2 to ¼- and ¾-in. square tools.

M. E. Cunningham Co., 95 E. Carson St., Pittsburgh 3, Pa.



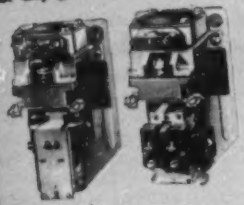
X-Ray Thickness Gage Measures Cold-Rolled Steel Strips

Cold-rolled steel strips ranging in thickness from 0.005 to 0.1196 in. can be measured in steps of 0.0001 in. by this Westinghouse thickness gage. The upper knobs on the operator's control regulate the tolerance-limit indicator lights for high-speed mill applications or the reject gates on a classification line. The second line of controls energizes and calibrates the gage, and the third line automatically sets up the sample thickness of steel to be rolled. Thickness of the sample in the standard X-ray beam is shown in the windows above these controls.

Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

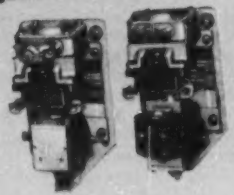
PNEUMATIC TIMERS FOR EVERY JOB A.C. or D.C.

for timing motor acceleration, machine sequences, process industry operations, etc. With wide variety of A.C. and D. C. timers, you can select exactly the right one for any given job.



above, left
A. C. Time delay after de-energization. Micrometer dial.

above, right
A. C. Time delay after energization. Electrical interlock.



above, left
D. C. Time delay after energization. Micrometer dial.

above, right
D. C. Time delay after de-energization. Electrical interlock.

THESE PROVEN ADVANTAGES OF A.C. DESIGN NOW FEATURED IN NEW D.C. TIMERS

ACCURATE—less than 10% variation, plus or minus, from mean timing period. Unaffected by normal changes in voltage and ambient temperature.

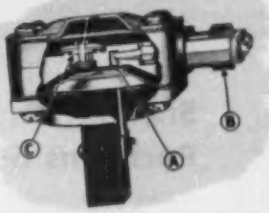
WIDE RANGE—timing period adjustable, 0.2 seconds to 3 minutes.

EASY TIMING ADJUSTMENT—quick fingertip setting of knurled knob or micrometer dial.

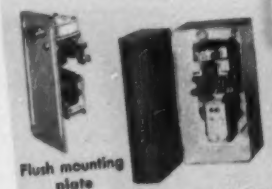
SNAP ACTION CONTACTS—normally open and normally closed in self-contained, arc-resistant melamine case—rated for A.C. or D.C. control circuits.

ELECTRICAL INTERLOCKS—operated by the magnet which actuates the timing mechanism—frequently eliminates need for additional switching relays.

THIS BASIC PNEUMATIC TIMER UNIT FEATURED IN ALL THESE TIMERS



How It Works: *Simple operating principle is based on the interval required to transfer a small volume of filtered air from upper to lower chamber through a regulated orifice (A). Rotation of knurled knob (B) gives wide range of adjustment. Air returns through valve (C) for instantaneous reset.*



Flush mounting plate

General purpose enclosure

Write for Bulletin 9050. Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

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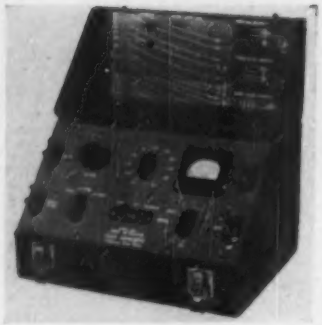


Bridge-and-Amplifier Unit Reproduces Load Records

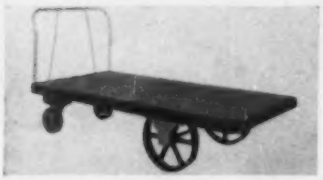
Operated in conjunction with SR-4 gages and a cathode-ray oscilloscope the BA-1 bridge and amplifier provides a versatile system, adaptable to measuring practically any mechanical reaction. Load measurements, stress analysis, and functional analysis during operation show amplitude, frequency, and waveform of sharp transients, steady state oscillations, static loads, and their combinations. Displacement, acceleration, vibration, damping, timing, weight, and pressure, can be seen and measured during the operation. The unit is a complete package of bridge elements, signal chopper, calibration system, amplifier, and power supply. Specifications include bridge input from 50- to 2000-ohm resistive elements. The signal-chopper frequently is 100 cps, voltage gain, 0, 10, 150, and 3000, and power supply is by batteries with 150-hr life.

Ellis Associates, Research and Equipment, Box 77, Pelham 65, N.Y.

Spring Safeguard Eliminates Punch-Press Pinch Point

The Elasticone entirely incloses the pin and bushing area of punch presses, eliminating the pinch point and protecting operators. This device is claimed to have increased pin and bushing life on presses as much as 20 to 40%. Inserted easily over the pin and bushing between the upper and lower shoes of the die-set, the Elasticone guide-pin cover is a cone-shaped spiral-wound flat steel spring of special alloy and temper. It may be obtained to accommodate punch-press die sets with bushing diameters ranging from 1½ to 6 in. and open heights ranging from 4 to 24 in.

Central Safety Equipment Co., Philadelphia 25, Pa.



Platform-Truck Deck of One-Piece Construction

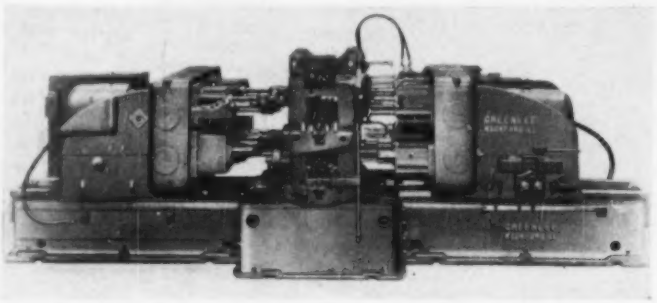
The entire deck of the Roustabout light-weight platform truck is die formed on a brake from one piece of steel and is then arc-welded to eliminate sharp angles and bulkiness. The trucks have inset welded handle pockets and rounded corners leaving no projections to catch on clothing or packages. Deck sizes of the Roustabout range from 24 x 48 to 36 x 72 in. with capacities up to 3 tons for level bed or 2½ tons for the tilting types.

The Rapids-Standard Co. Inc., Department RT-338, 348 Rapistan Bldg., Grand Rapids 2, Mich.

Metal-Marking Stamp Set Presents Eight Fractions

Fractional-figure stamps are made of high-grade tool steel, blued for rust-prevention. Striking heads are tempered by a special process said to prevent chipping or mushrooming. The set consists of nine stamps reading from ⅛ to 1 in. in eighths and includes a separate inch sign.

Acme Marking Equipment Co., 8030 Lyndon, Detroit 21, Mich.



Six-Station Transfer Machine Performs 60 Operations

Employing a double-deck system, this machine performs 60 drilling, reaming, and tapping operations on the sides and ends of cylinder and valve housings. The part is first loaded into the lower deck where 50 drilling, reaming, and tapping operations are performed. It is then turned 90° and placed in the upper deck where the remaining ten drilling and reaming operations are completed. To hold to close tolerances required during machining operations, parts are located in both decks by dowel pins and held firmly in pneumatically powered wedge clamps. Work pieces are transferred manually from one station to another through a continuous-chain system. A locking device makes double indexing impossible until the cluster heads have completed the machining cycle.

Greenlee Bros. & Co., Rockford, Ill.

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POURS THROUGH SANITARY VALVES OF *Free-Machining* ENDURO STAINLESS STEEL

There's no compromise with quality when it comes to protecting the taste and purity of America's favorite soft drinks. That's why sanitary, easy-to-clean, corrosion-resistant ENDURO Stainless Steel (Type 303) is used for these fountain dispenser valve parts.

From a manufacturing standpoint, there are other reasons, too, for the specification of ENDURO Cold Finished Bars. Close tolerances . . . accuracy of section . . . uniform soundness . . . fine surface finish . . . and UNIFORMLY HIGH MACHINABILITY . . . all combine to keep down unit costs and reject losses.

Whenever you need top machinability plus one or more of the other qualities which only stainless steel can provide, remember to specify Republic ENDURO Stainless Steel Bars—cold finished or hot rolled—and wire. Available for prompt delivery. Write us *today*.

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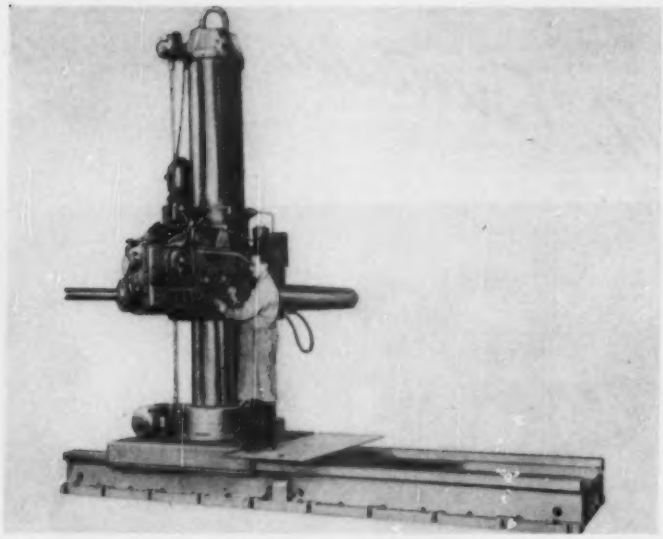
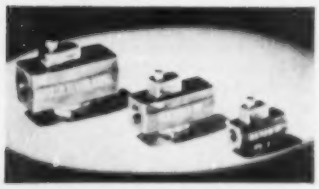


Drilling, Tapping Machine Swivels 360° on Vertical Column

Heavy-duty horizontal drilling and tapping machine is equipped with a 4-in.-dia nitrided spindle with 36 inches of manual and power feed. The head swivels 45° up and down from the horizontal position and the 22-in.-dia column swivels 360°. Model 1040 can be used as a stationary fixed-location machine or as a portable unit with spreader arms, leveling jacks, and lifting bail. It offers a choice of three speed ranges from 25 to 300 rpm and four feed ranges giving spindle feeds from 0.0035 to 0.125 in. per rev. Spindle has No. 5 or No. 6 Morse taper hole.

An automatic tapping device, mounted on the headstock, permits accurately controlled tapping to predetermined depth and provides automatic spindle reverse when desired tap depth is reached. The rail and head assembly has 48 in. vertical power traverse with inching controls for final tool positioning. The column has 48 in. of horizontal travel with inching controls and rapid power traverse provided. All swiveling units are graduated in degrees and half degrees. Inclosed electrical collector rings are mounted on the column base to transfer power to the head and eliminate cable windup when the column is rotating.

Kaukauna Machine Corp., Kaukauna, Wis.

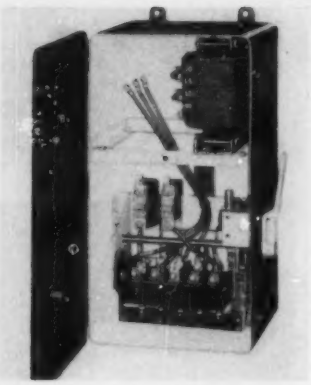


Speed Control Valve Offers Special Safety Device

An "O" ring seal above the threads on this speed-control valve for pneumatic cylinders permits air to escape well before the threads disengage, warning the operator that the point of maximum adjustment has been passed. The valve provides metered flow away from the cylinder by means of a large-diameter tapered valve stem, threaded to permit sensitive adjustment from zero to maximum cfm. For speed control in both directions on double-acting air cylinders, two valves are used—one in each of the lines leading to the cylinder ports. Valves are made in ¼-, ⅜-, ½-, and ¾-in. pipe sizes and can handle pressures up to 150 psi.

The poppet is faced with synthetic rubber to provide a positive seal and is loaded with a phosphor-bronze spring.

Hannifin Corp., 1118 South Kilbourn Ave., Chicago 24, Ill.



Motor Starter Regulates Starting Current

Manual autotransformer starter for squirrel-cage motors has two automatic-reset overload relays and is available in four sizes from 5 hp., 220-440-550 v., to 250 hp, 440-550 v; for 25, 50, and 60 cycles. The timing-delay mechanism, for controlling the length of accelerating period before switching the motor from starting to running taps, is adjustable from 0 to 15 sec. The starters come with both air-brake and oil-immersed contacts.

Allen-Bradley Co., Milwaukee, Wis.

Rubber Bearing Seals Keep Lubricant In, Dirt Out

An oil-resistant rubber-coated fabric in contact with a specially formed metal shield on the "Composition-Sealed" ball bearings are claimed to effectively retain lubricant and exclude foreign material. These shields are available in the Series 1600 "ground all over" precision annular bearings and the Series 3000 unground radial bearings.

Nice Ball Bearing Co., Philadelphia.

Steel-Weld FABRICATION

Here, in this marine steam engine frame which was formerly produced in casting form, is another excellent example of fine workmanship in Steel-Weld Fabrication. It is typical of thousands of heavy machinery parts and assemblies produced by Mahon for manufacturers throughout the country. Whatever your requirements may be, regardless of size or weight, you will find in the Mahon organization an unusual source for welded steel in any form . . . a source with complete production, handling, and machining facilities, backed by a staff of competent design engineers and craftsmen from whom you may expect a smoother, finer appearing job, embodying every advantage of Steel-Weld Fabrication.

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Here Dake's 70-ton Hydraulic Press takes over the fatiguing job of stamping special designs on steel molds used in manufacture of rubber bath mats. Quick application of the 27-45 ton pressure required for the hobbing, or stamping operation saved five hours per plate, eliminated the heavy hammers used in hand application, improved precision and work quality.

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ROUND TABLE *Discussion*

PAYING—OR PAID GUESTS?

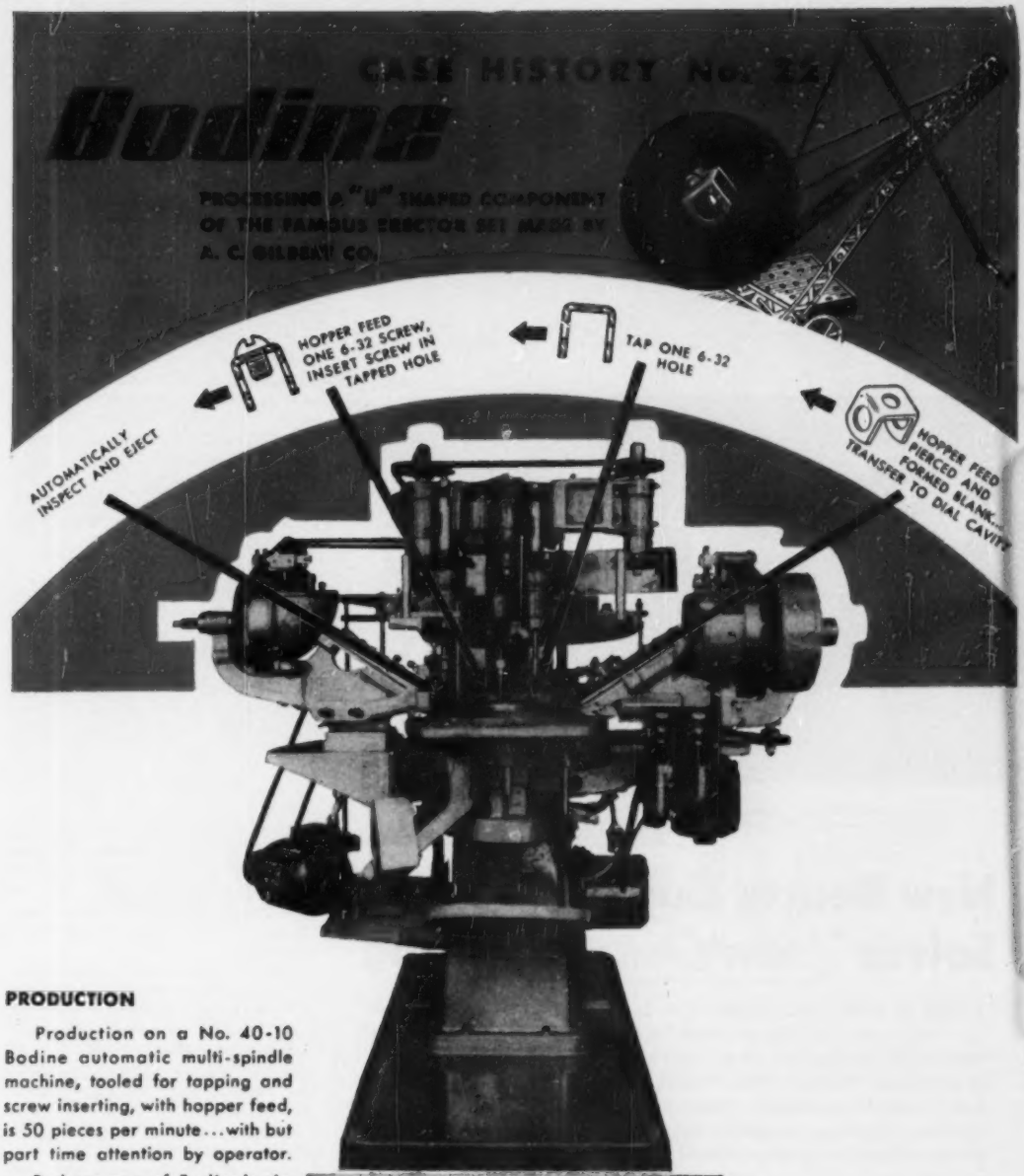
The "Ed's" of the Industrial world who have (and push) the idea that summer or part-time hiring of young 'uns or "college-men" is pure misguided philanthropy are too plentiful. Fortunately for a lot of us alumni of vacation apprenticeships, they've only made themselves felt to any extent in recent years. Oh there were always a few, but a fellow could apply next door or across the road or even the next department if he happened to trip over one.

It appears to be an unhealthy situation and, pessimistically perhaps, unless something is done rapidly it is going to get worse to a point where it will wreck the structure American labor is or thinks it is building. Some parts could stand wrecking, but basically not the whole.

In an age all too familiar with the cries of "Soulless Corporations," "Mass Production," "Man, the Minor Cog," the noise made by iconoclasts all but dins out the realization that back of every product of matchplate, die, conveyor line or open-hearth are individuals whose own single skills, pride in and reverence for, as well as knowledge of, their craft has either created or contributed to the making and success of those machines.

To watch these men at work still provides one of the thrills of industrial living but sometimes this is shadowed by the awareness of the sins being committed against them by their very craft—the great numbers who are riding through on a classification of "machinist" or "toolmaker" and yet neither own nor appreciate or are even aware of the chalices of that trade. HS steel, carbides, files, etc., are relatively cheap and easily come by, so few protest nowadays when these butchers commit metallurgical mayhem on what were once tools, the correct use of which took much practice and training to acquire. Sine bars and Jo blocks once represented the acme of one's own handwrought toolbox jewels, but you can buy them mass-produced nowadays. However woe unto him who tries to make a living selling them—he may have to look quite a while to find "toolmakers" that know what he's talking about, let alone need or are able to use them.

There is no need for anyone to


CASE HISTORY No. 22
Bodine
PROCESSING A "U" SHAPED COMPONENT OF THE FAMOUS EJECTOR SET MADE BY A. C. GILBERT CO.
HOPPER FEED ONE 6-32 SCREW, INSERT SCREW IN TAPPED HOLE
TAP ONE 6-32 HOLE
HOPPER FEED PIERCED AND FORMED BLANK—TRANSFER TO DIAL CAVITY
AUTOMATICALLY INSPECT AND EJECT

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Production on a No. 40-10 Bodine automatic multi-spindle machine, tooled for tapping and screw inserting, with hopper feed, is 50 pieces per minute...with but part time attention by operator.

Perhaps one of Bodine's six standard sizes can be tooled for your specific job. Milling, Drilling, Tapping and Screw Inserting may be included in one machine...for high speed, low cost production.

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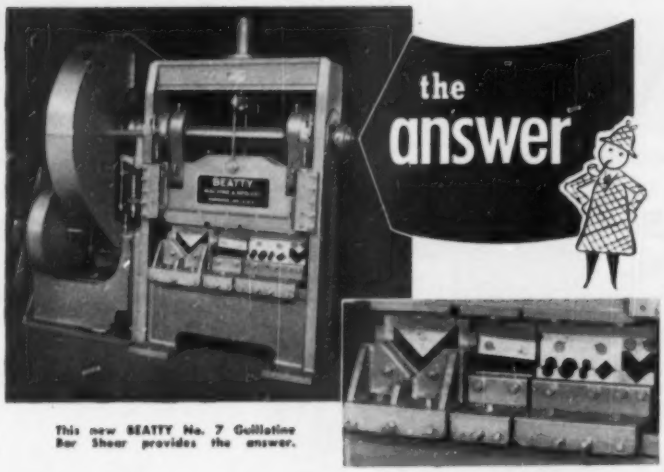
Send for Catalog which gives all technical details. Ask Bodine engineers for practical recommendations.

6B048

The problem was "short order" warehouse shearing — one of this, one of that, one of the other thing.



This new BEATTY No. 7 Guillotine Bar Shear provides the answer.

New Beatty Guillotine Shear Solves *"Short Order"* Shearing

Typical of Beatty problem-solving is this new bar shear which allows for "short order" shearing of rounds, squares and bars *without* changing tools. The new machine offers a 48" base on which are mounted 2 sets of angle shear blades, 1 set for shearing flats, and blades to shear squares and 3 sizes of round bars. Other tools for shearing other shapes are available. Let Beatty engineers help solve your problems. These machines are built in capacities from 50 to 450-tons.

Write for data on this new Bar Shear

HYDRAULIC POWER METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

consult the history books for reports of what has happened to the quality of man's works whenever the rules of trade-learning have been slackened, especially if he purchased or looked at, in the last four years a mechanical refrigerator, stove, furnace or automobile, to find the welding or fastenings reminiscent of barnyard repairs in the midst of a busy harvest. If we consider the "contribution" of summer training of embryonic engineers or other industrial students' misguided philanthropy, then hire those unexposed to shop traditions whose "finish" concept can only be what they have seen on recent markets. Or, if we insist on those with an apprenticeship background gained at someone else's expense—then what? Surely the philanthropy may be the other fellow's —but all too soon we will realize we are the misguided.

A. M. Elliott
LeRoy, N. Y.

•

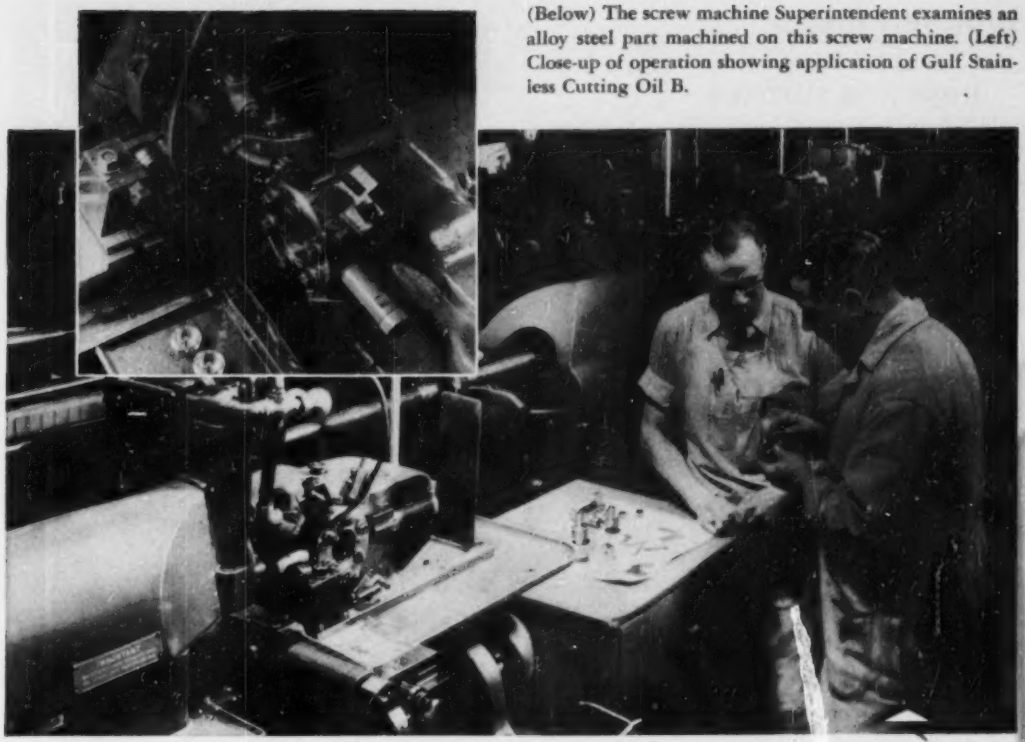
This question has been up for years, and I think Round Table is rendering a splendid service to young engineers by bringing it into notice in the column.

Since these young men are the green timber of the nation's future engineers, I think industry should bend a point and give the deserving young man a chance. Of course there are some that seem to be useless and can't adapt themselves to regular problems, while others have the snap and will to do and take hold of situations offered them. The situation is to be encouraged to enable boys to assist parents in putting boys through college, which comes pretty high these days.

I know one boy who had his course and life spoiled through failure to make expenses at the end of his third year. This fellow was a very smart mathematician, good mechanical head with ability to see through problems. His parents had mortgaged their home to carry him. Then depression caught up with this very smart boy who is around 40 now and just a laborer. Had someone of this college's Alma Mater given this boy a lift a parent could have paid a mortgage and the country gained a clever engineer.

I believe the Alma Mater of many colleges do take on as many of these young fellows as they can. I think it a good cause and while some may argue that about time you get them broken in to a job it's time to go back to school. OK, that is right but we owe this to the next generation on the basis that we should not take all

(Below) The screw machine Superintendent examines an alloy steel part machined on this screw machine. (Left) Close-up of operation showing application of Gulf Stainless Cutting Oil B.



"We get the extra fine finish we require with

Gulf Stainless Cutting Oil B"

says this screw machine Superintendent

"We have improved production on our screw machines since we switched to Gulf Stainless Cutting Oil B," says the screw machine Superintendent of this sewing machine manufacturing plant. "We get the extra fine finish we require and keep rejects to a minimum."

"We are working to a tolerance of .0005 inches on this alloy steel part, use 20 different gauges to check dimensional accuracy—and with Stainless Cutting Oil B we get this accuracy without a grinding operation."

A typical example of how the most suitable Gulf Cutting Oil improves machining practice! For practical assistance on your cutting oil problems, call in a Gulf Lubrication Engineer today. He will make specific recommendations which will help you get longer tool life, better finishes, and increased production.

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and give nothing to this world of ours in return. The big fellows leave scholarships, grants, libraries, etc. So I say it is good for all to sponsor these boys and if you can't found a library or endow a scholarship you can help with a few months work. Who knows that boy might give the plant or even the world a wonderful lift with a valuable idea some day.

I say this kind of philanthropy pays off to the world and that helps the individual indirectly, at least. So give the boys a lift, Mr. Businessman, if you can.

Henry Rasmussen
Niagara Falls, N.Y.

•

I believe that Al has the right approach to the question. There are all types of young fellows who need summer employment to assist in their search for higher education. Some of these are like some of the men in the shop already, not worth a damn, but there are also those with a future in mind that calls for a good working background in shop fundamentals. And where is a better place to acquire this knowledge than in a good, well-planned shop? Sure there are school shops where certain ideas and jobs are attempted, but these can't compare with the majority of plants in the country for giving a complete coverage of what the shop has to offer.

There are also lots of operational skills that don't require but a minimum of the foreman's time to show the newcomer, such as bench work, drillpress work or running a setup job. In many instances this allows a skilled craftsman to take on other work where his ability is needed. I, myself, spent many such summers doing any odd job that happened to come my way. Some of the time I spent on the long end of a push broom, but even this was valuable time to me because with the knack of keeping my eyes and ears open, I was able to absorb much that has been of great value to me in my later experiences. As to the value of education, I am heartily in favor of a youngster going as far as is able before settling down to any one job. This in the end will give a worker who has well-rounded experiences the ability to cope with situations that will stump one of lesser knowledge, and if the final choice is that of engineering, a working background is more valuable than all of the work the youth is able to get.

Shops no longer go by the process of having a youngster learn the trade by long years of experience on this and that operation. That is more or less gone with the years. Yes, it was

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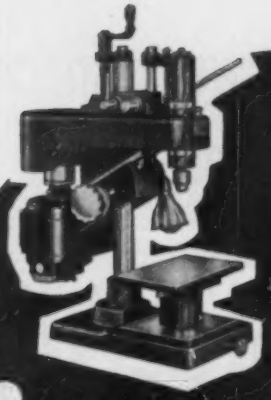

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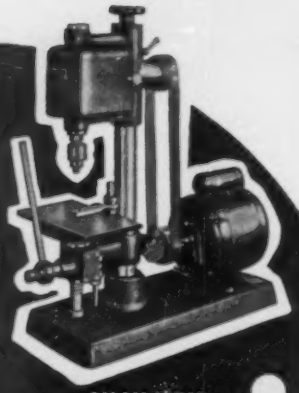
The Hamilton Varimatic Drill has stamina. All of the stamina needed for hard, continuous production work. But it is also a tool of precision; built to extra close tolerances for the drilling of small, precision holes (.004" to 5/16") in materials as diverse as paper and monel or ceramic and bronze.

Speed is infinitely variable between 840 R.P.M. and 9300 R.P.M. Clearance from center of chuck to column is 5", from table to chuck, 9½".

Our bulletins V-47 and T-47 illustrate and explain these two precision machines in detail. Write for them!



SMALL HOLE

PRECISION TAPPER

COMPANION TOOL
TO THE VARIMATIC DRILL

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The spindle of the Hamilton Super-Sensitive Tapper idles in reverse, and thus may be centered without cutting. When pressure is applied to tap, direction of rotation changes and tapping begins. Release of pressure again reverses rotation and reduces speed to "idle" instantly and automatically, withdrawing tap from hole!

This feature, and the tapper's adjustable stops, make possible the tapping of blind holes to the very bottom without danger of tap breakage and in a minimum of time.

Capacity of the Hamilton Tapper is from the smallest and finest tap to 10-32 inclusive. Spindle speeds range from 1200 R.P.M. to 2600 R.P.M. Clearances; center of chuck to column, 3¼", and from table to chuck, 3¾".

THE Hamilton TOOL COMPANY

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valuable in times that were moving more slowly than they are now, but there is not that great time loss and it is found that many capable men are able to pick up this information with much less time on the job and more time spent in study of working conditions.

With a little of both, our boy in the shop this summer will one of these days be the mechanic or engineer of tomorrow. If we cannot see to his future, with the expenditure of a little of our time and materials, with of course some gain for ourselves through his honest efforts, then the mechanical superiority that we so proudly claim and hold for our enterprising nation will fall to those who take pride in their youth and give them a chance to become the men of tomorrow.

Jack Bell
Bakersfield, Calif.

•

I believe that Ed is taking a foolish and selfish attitude about this matter. Take his remark that these college boys might be a couple of nephews of the old man. I don't see what difference that should make at all. They are two young men seeking knowledge and prepared to give up their summer vacation to get it. We used to have these young college and university students come into the shops every summer for many years.

It was a huge plant and around 100 students spent their vacation working, some in the foundry, others in the pattern shops and the rest in assembly or machine shops, and they were paid learner's wages, very small. Some of them belonged to the wealthy families and stayed in hotels; others in cheap rooming houses. We started work at that time at 6 AM and of course they had to be there on time.

There were also the sons of two or three of the Big Shots. As Ed sarcastically remarked, I do not see what difference whose sons they were or whether rich or poor. They all were seeking to attain a knowledge of the industry, the methods and to use the experiences gained in furthering their career. I believe that any young fellow who gives up his vacation to work through the summer is worth all the assistance of all the personnel in the plant he comes into during his vacation.

The money they earned certainly did not have anything to do with their decision to work during the vacation. It was a mere pittance.

There were foremen who were hostile to the idea at first, just like

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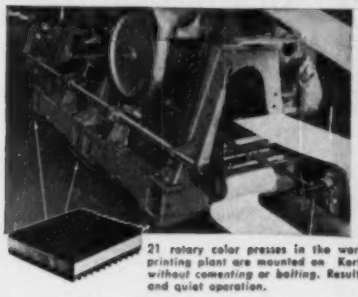

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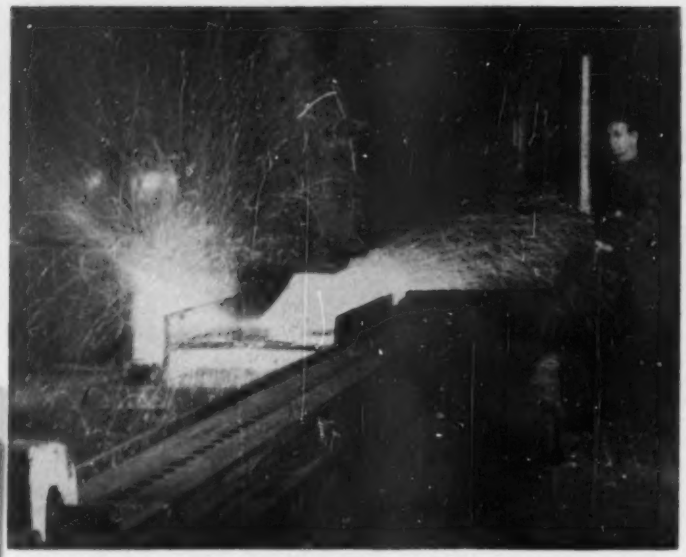

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Ed, but these students proved themselves so quick at getting hold of the simple pieces of work they were given and showed such willingness to work that, before very long, everyone in the shops did all they could to make their stay pleasant as well as profitable.

About Ed's remarks that they, the students, would be somewhat dumb and worse, it was our experience that apart from not knowing at the start anything at all about the machinist trade from the working end of it, they were far superior in lots of other ways than the Boss who was temporarily their teacher. They were smart in mathematics, could figure any shop problem out, and as it was an Ordnance plant there was plenty of figuring to do and here they were of real help.

There was no philanthropy here. They earned more than they were paid and I venture to say that today in the majority of shops, whether slack or busy, any executive who is alive to ways and means of keeping men occupied, also has a program of all the things there are to do, could easily keep a couple of students busy and pay them for it at apprentice rates.

Ed states that if they can use any more help, why not engage a couple of young fellows who after training will stay with them for perhaps two or three years, and so repay for their cost during the training period, instead of taking those students who never intend to follow the machinist trade as machinists anyway.

It is true that these young students do not intend to end up as machinists. It is also true that the machinist as such would be of practically no use if it were not for the scientist, designer and the engineer and the chemist, from whose ranks probably 90% of the college students come. By being allowed to spend their vacation getting practical first-hand experience, it helps to enable them to become the future leaders in the industry.

Those young students are not in any favorite class. Any young man who wants to get ahead and has guts, a liking for hard work, and has real ambition, mechanical ability and a flair for leadership, and who will study hard to fit himself for a responsible well paid job, will go just as far as he wants to go. There are lots of old time machinists whose sons have risen to the position of leadership in industry by using their spare time to qualify themselves to take the fullest advantage when opportunity knocked at their door.

In conclusion, Ed, if you will take two college students who have a lik-

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FAST SET-UP . . . adjustments for cutting speed, feed, cutting stroke length and related machine movements are made quickly with levers or hand wheels.

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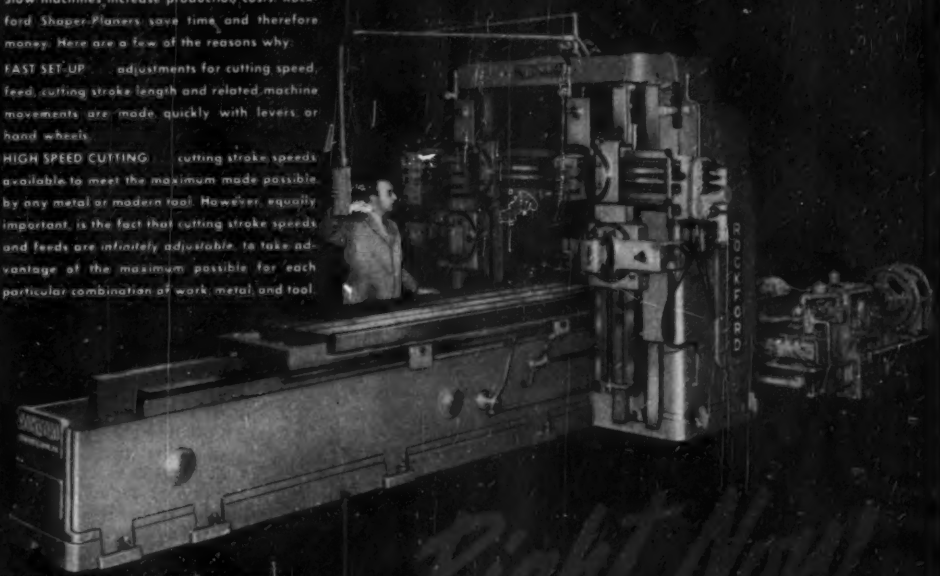

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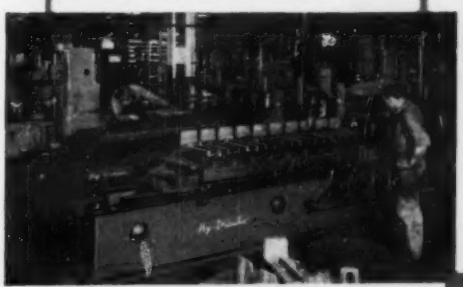

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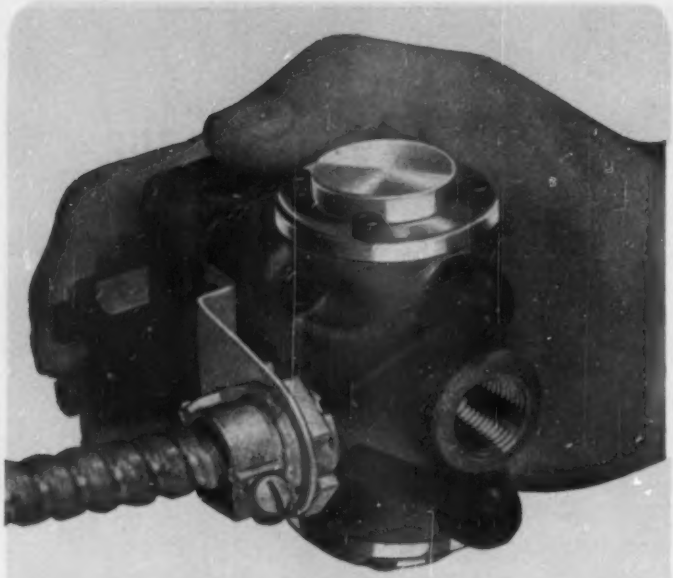

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ing for hard work and a sincere desire to learn all they can, and give them three months' work during their vacation with intensive training at apprentice wages, I venture to state that they will be sufficiently capable of producing and just as efficient as the majority of the fellows who have been for years in the industry.

This is not to insinuate that they will be first class machinists. They won't be, but they will have absorbed enough of the know-how of the trade to get their living if necessary in the future.

Arthur Silvester
Niantic, Conn.

•

Ambitious young men are ever looking for places during any spare time that they may have where they can learn something about the business that they prefer to enter in the future. They are not satisfied to seek a place with the first concern that they may happen to run across but invariably seek the place whose product bears the best reputation; in other words they desire to learn from a place that has a reputation of making the best products.

It is my belief that Industry as a whole pays for the education of its employees and that the best shops as mentioned above get the most desirable help and are the group not only getting the best help but without additional cost.

One supt. whom I knew boasted that his firm never employer apprentices, saying that there were enough firms who did to supply the need for all. When asked what would happen if all firms did likewise, his answer was that as long as other firms do furnish enough for them he was not concerned.

However it goes without saying an unwillingness to share the burdens of life leaves its mark on organizations and individuals, and in the long run I don't believe it is either profitable or fair play.

Abel Blakeman
Watervliet, N. Y.

•

If the shop or plant is busy and can use additional help other than regular employees I would say, yes, we should take them in during the summer months. If, however, the orders should slow up causing a curtailment they should be the first laid off.

Our young men of today are our engineers of tomorrow and we must be considerate of their feelings and thoughtful of their desires to learn all there is to know about the careers they have chosen. Certainly when

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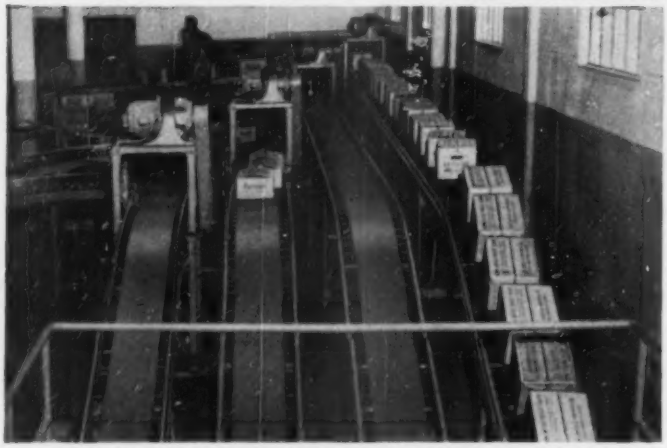

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possible we must help in their education, both practical and technical. It is very desirable that they know how to use their hands as well as their heads. Many of our colleges do not keep abreast of industry in modern machinery so necessary for training.

It is my opinion that a good engineer should learn how to roll up his sleeves and help out when difficulties arise.

We must keep in mind these facts —our engineers and scientists have been largely responsible for making this country the richest in the world. We must look ahead with the idea of building more plants and bigger, more modern, machinery. Our engineers must find better ways to do the job and together with other professions must find new products to manufacture.

My advice to these freshmen would be to learn all they can wherever and when they can. What they don't learn may not hurt them but it may amuse others . In helping our engineers we are eventually helping ourselves. By being interested in others they in turn will be interested in us and it is the only way to persuade someone that with a merging of ideas we all attain the things we all want.

A. E. Salmons
Philadelphia

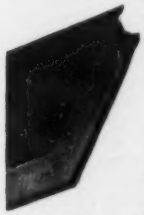
•

TEN O'CLOCK SCHOLARS

Almost one could fine oneself in agreement with Ed; as kind-hearted, so considerate, so ready to accept any and every kind of excuse his men may offer for being late, logical or otherwise. One should guard against adopting a hypercritical attitude, however, because by their very nature, accidents are not logical happenings. Everyone knows that it is easy to knock a clock down; lose a collar stud; break one's braces; snap a shoelace; find one's tire is down. Yes, a puncture is a fine excuse, actual or imaginary and, if need be, a pin suitably applied, will give demonstrable proof. Then how often does not the wife get a headache, particularly after the naughty lad comes home late and knocked the clock down, and, perhaps, was unnecessarily vociferous and active and overslept as a result.

Perhaps Mullins was just unlucky or had been seeing things—blue devils perhaps. The trouble is there may be more than one Mullins; it may even be that Ed's considerateness is being abused and that it may be he would find it difficult to pluck up courage to say so to the proverbial goose. It may be urged that this should not really matter, that one Mullins more or less ought not to

Quick aid in solving practical design problems



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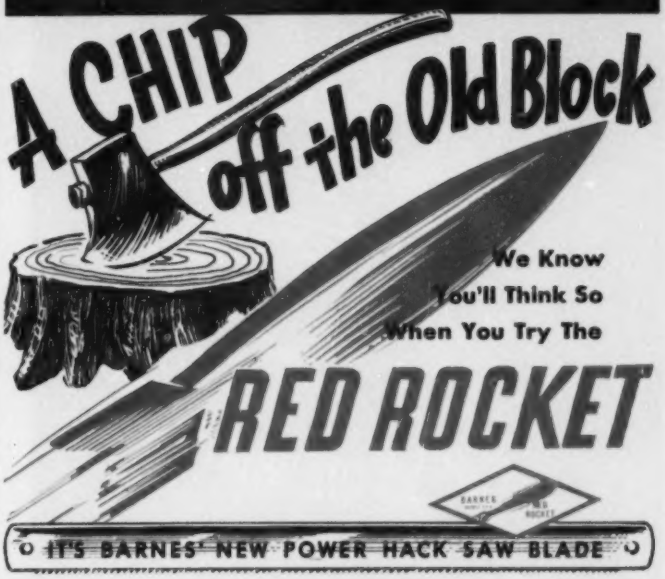

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matter much. Yes, but this Mullins is a "crackerjack" once he gets going. Ay, but if crackerjacks can do as they please, come and go when they like, what about production programs and that special job promised, certain, today? A shopful of Mullins' could play havoc with programs, delivery promises, and shop discipline. Like the cow's tail, they would always be behind. Why not lock the gates at starting time and let latecomers see the manager?

No, Ed must give up shilly-shallying and learn to say boo—a big boo—to that goose; he must tell Mullins that his hours are the same as those of other men and that there is room for good timekeepers only. Ed will be surprised to find how their relative sizes and positions will have changed and will realize that after all Mullins was not such a big guy or so wonderful as he previously seemed to be. Ed will have grown where growth was sadly needed.

J. E. Powell
Lindum, England

NEW BOOKS

THE FERROUS METAL INDUSTRY IN GERMANY, 1939-1945. *(Over-all Report No. 15). Published for the British Intelligence Objectives Sub-Committee by His Majesty's Stationary office, London, England. 270 pages. Price 4 shillings, sixpence.*

This book is a detailed reference on the development and progress in German ferrous metallurgy in the war years. The 400 reports of 120 teams of British and American experts, who surveyed German plants and practices, have hitherto been dispersed and often inaccessible to interested persons. Now, in this volume, the reports are correlated and condensed and the original references are listed. Among the nine sections, those of interest to metalworking personnel are: steels, hard metals, heat-treatment, cutting and joining, fastening, research and testing techniques.

•

STRENGTH OF MATERIALS—*By J. P. Den Hartog, professor of mechanical engineering, Massachusetts Institute of Technology. McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. Price $4. 323 pages.*

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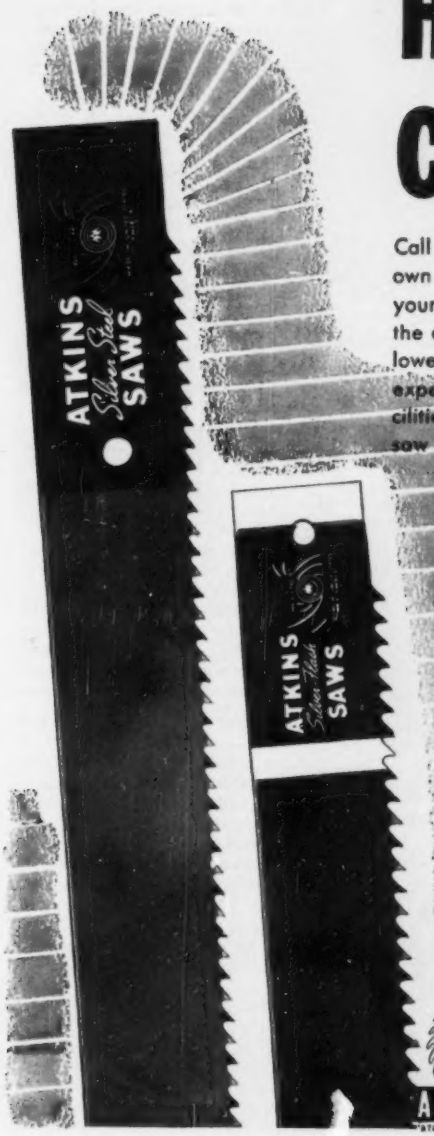

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•

WELD DESIGN—*By Harry D. Churchill and John B. Austin. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. 216 pages. Price $6.65.*

Increasing interest in the use of weldments for machine bases brings to light the paucity of available literature on this subject. Hence this new book supplies a definite need by furnishing engineers with up to date information on welding procedure.

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•

TROLLEY CONVEYOR—*By Sidney Reibel, materials handling consultant, Albert Kahn Associated Architects and Engineers. McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price $4. 265 pages.*

Covering all phases of design, installation, and operation, this book is a complete manual of the trolley conveyor. As such, it contains all the information necessary to the solution of handling problems involving this type of equipment, and thus is invaluable both as a reference book for those actively engaged in production planning, and as an authoritative

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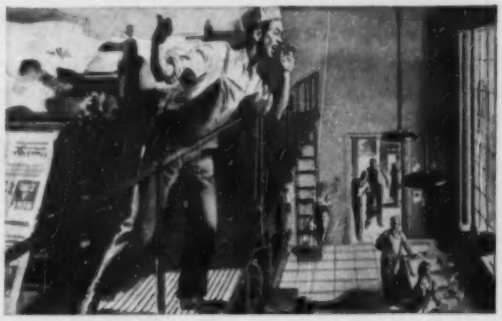

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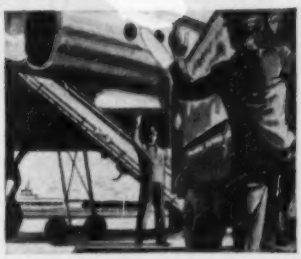

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One chapter, designed for the busy executive, outlines the points to consider in the purchase of a conveyor and contains in condensed fashion the information presented in detail in the chapters that follow. How to lay out conveyors is covered and vital statistics are available from tables covering such items as power requirements, I-beam sizes, and other specific application data.

•

PRINCIPLES OF MAGNAFLUX. *By F. B. Doane, President, and C. E. Betz, Vice Pres., Magnaflux Corp. Published by Photopress, Inc., 731 S. Plymouth St., Chicago, Ill. 388 pages, 6 x 9 in. Price $5.*

For the man who uses, or contemplates using, magnetic inspection equipment, this book is a "must." That it is sufficiently practical to warrant the writing of a third edition speaks for itself. Edition one was published pre-war; the second edition, with three printings, was for war training. Now, this latest edition provides a clear picture of the know-how that has come out of war production and many postwar advances. Results are described that, now commonplace, were thought impossible for the Magnaflux of nine years ago. Among these are the use of Magnaglo in many applications, including railroad inspection; also important is a description of modern semi- and fully automatic equipment. There is a new discussion of field distribution and a new analysis of the factors which affect the detectibility of discontinuities.

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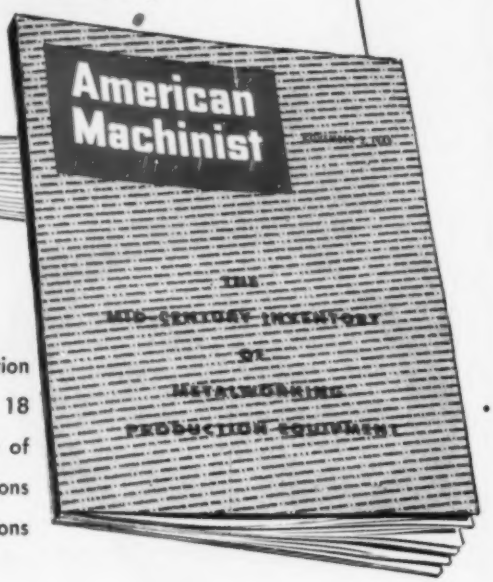

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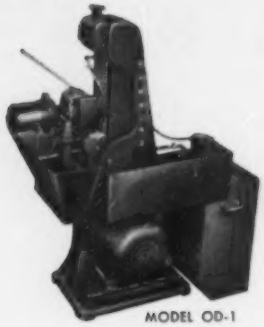

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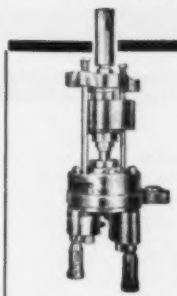

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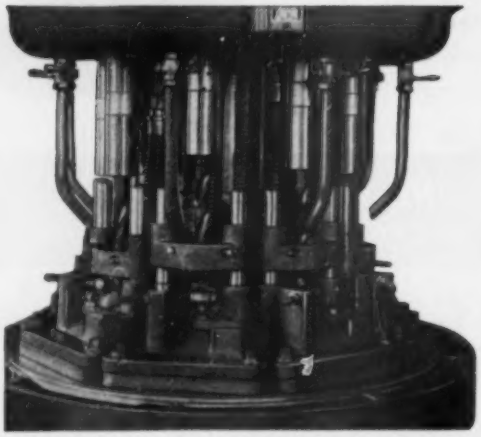

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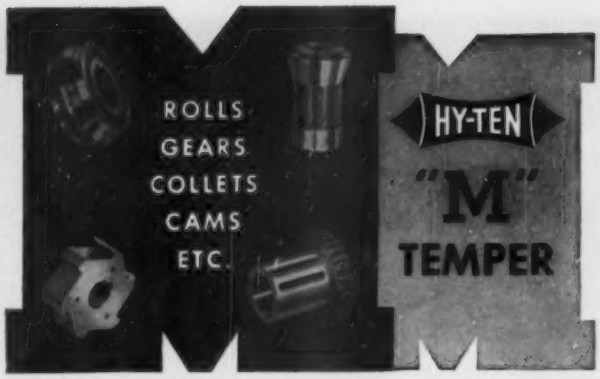

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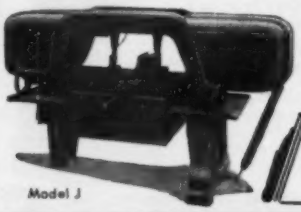

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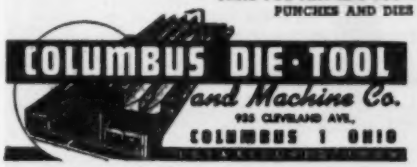

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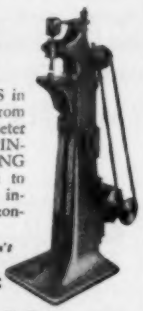

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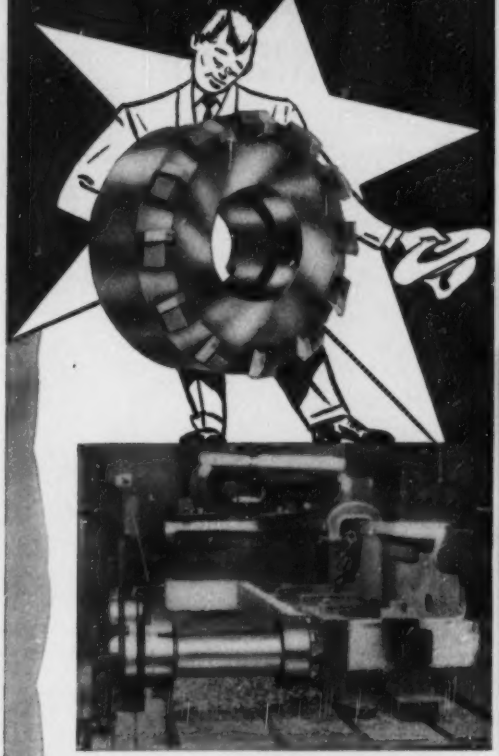

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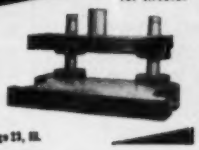

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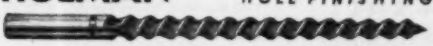

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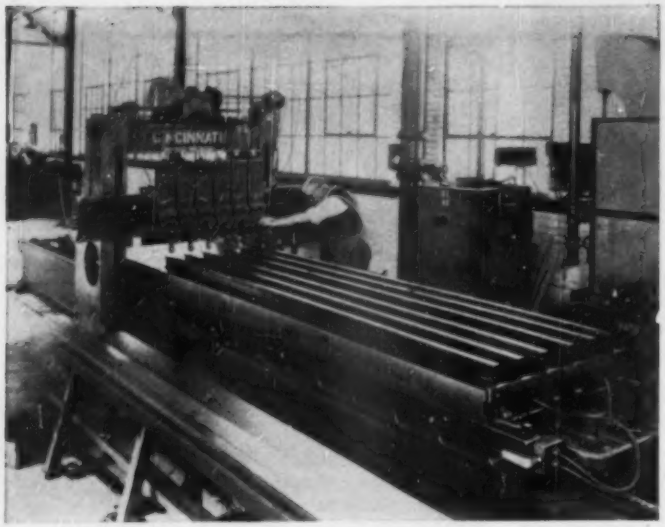

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ATOMIC AREA! Is your organization geared for this emergency! My employment could increase your production and profit. 10 years of resultful experience in production, sales and supervision in the precision machinery field. Successfully installed wage incentive, designed special machinery, plant layout, process, sales and supervise. 35 yrs. old. Additional facts furnished to prove my ability. PW-1124, American Machinist.

EXPORT MANAGER: Experienced in foreign promotion, distribution, credit and traffic. Will aggressively promote sales of your production Latin American markets. Fluent Spanish. Available short notice. PW 1765, American Machinist.

MANUFACTURING EXECUTIVE. Broad successful industrial experience directing and coordinating all Manufacturing, Purchasing, Planning, Engineering and Production. Aggressive, cost minded, resourceful. Excellent references. PW 1314, American Machinist.

BUSINESS OPPORTUNITY

Mechanical Engineer

with Shop, Designing and Sales experience wishes to invest $20,000 in small going shop where services can be used to advantage. BO 1795, American Machinist.

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Patent Practice

before U.S. Patent Office, Validity and infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine and Rommel, Registered Patent Attorneys, Suite 453, 815-15th Street, N. W., Washington 5, D. C.

NEW ADVERTISEMENTS

Copy received by January 10th will appear in the January 23rd issue.

HELP! HELP!

Phila.'s most complete metal working organization covering all phases of machinery building, production machining, fabrication, gear cutting, etc. needs men to actively solicit or inactively direct us to work opportunities.

P-1800, AMERICAN MACHINIST
330 W. 42 Street, New York 18, N. Y.

WANTED SUPERINTENDENT

Aluminum and zinc die cast plant in Western Michigan employing 75 men. Must be acquainted with die design, production methods and maintenance problems. Give particulars as to age, experience and salary expected.

P1429 AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

WANTED
MAIN DISTRIBUTORS AND STOCKISTS
for
BROOK POLYPHASE MOTORS

Brook Motors Limited make only alternating current induction motors between 1/6 and 200 horse power and have an annual output of 250,000 motors with a turnover exceeding 10,000,000 dollars.

They are looking for distributors who can stock and market between $250,000 and $1,000,000 worth of motors a year.

They offer a competitive priced, extremely sturdy and reliable product for early delivery. All motors would be made to comply with N.E.M.A. Standards.

Various types of enclosure can be offered and any special requirements incorporated.

They wish to contact a progressive American Company having Technical Engineers and good financial standing to act as MAIN DISTRIBUTORS throughout the United States.

Write immediately to The Managing Director

BROOK MOTORS Limited, Huddersfield, England

giving details or present organization

Personal contact can be arranged

INCREASE SALES

Consulting Sales Engineer: 10 years' successful experience in light and heavy machinery now available. Age 35. Resume furnished.

SA1329 AMERICAN MACHINIST
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WANTED TO BUY

3" and 4" National or Ajax Header

Late Model, with air clutch.

W-1705, AMERICAN MACHINIST
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WANTED TO REPRESENT IN GERMANY

Our German office already represents top U. S. machinery concerns. Its technical director considered the foremost mechanical engineer in Germany today has wide experience and following. We seek new representations from manufacturers of industrial machinery to be sold to the steel and metal working industries.

RA-1810, AMERICAN MACHINIST
330 W. 42 St., New York 18, N. Y.

FOR SALE
75 YEAR OLD MANUFACTURING BUSINESS

Catalog items — distributed nationally. Will sell patterns, jigs, fixtures, stock, work in process.

Price $75,000

PRINCIPALS ONLY.

BO-1801, AMERICAN MACHINIST
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MORE STAINLESS STEEL & ALUMINUM

Sheets • Strip • Wire • Rod Tubing

Quotations given on your dead inventory.

PROMPT REMOVAL—IMMEDIATE PAYMENTS

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EASTERN REBUILT MACHINE TOOLS

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No. 4D Potter & Johnston, m.d., latest
6 spindle 1⅝" sems, m.d., latest
4 spindle 1¼" Conomatic, m.d., bar, 1942 machine
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
14" Fay Flanders Type, m.d.
20x20" Jones & Lamson, m.d., latest
4 spindle ⅞" Model R-4 Acme-Gridley, m.d.
4 spindle 2½" Cleveland Model "K", m.d.
2½" Gridley Single Spindle, m.d.
2½" Cleveland Model A, m.d.
4½" Cleveland Model A, m.d.
4½" Cleveland Model A, m.d.
5½" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
7½" Cleveland Model A, m.d.

HORIZONTAL BORING MILLS

No. 0 Giddings & Lewis, m.d., 3½" bar
2½" Cleveland, m.d.
3½" Cincinnati-Gilbert Floor Type, m.d.
No. 25T Giddings & Lewis, m.d., 2½" bar, latest
No. 21 Lucas, 3" bar, m.d.
No. 45 Giddings & Lewis, m.d., 5" bar
4" bar Detrick & Harvey Floor Type, m.d.
5½" bar Niles, m.d.
10" bar Sellers Floor Type, m.d.

VERTICAL BORING MILLS

24" Bullard New Era, m.d., with side head
28" Bullard Spiral Drive, m.d., with side head
36" Bullard New Era, m.d., with side head
42" Bullard New Era, m.d., with side head
42" Bullard Spiral Drive, m.d., with side head
42" Colburn H.D., m.d., 2 swivel heads
42" King, bolted m.d., 2 swivel heads, p.r.t.
48" Colburn H.D., m.d., 1 turret, 1 swivel head
48" Putnam H.D., m.d., 2 swivel heads
54" Colburn, m.d., 1 turret, 1 swivel head
72" King, m.d., 2 swivel heads, 1 side head, latest
100" Niles Heavy, m.d., 2 swivel heads, p.r.t.
100" Niles Extra Heavy, m.d., p.r.t., late
120" Niles Heavy, m.d., 2 swivel heads, p.r.t.

RADIAL DRILLS

3' American Sensitive, new
4'-12" American Triple Purpose, m.d. on base
4'-12" Foodick, gear box
4'-10" American, gear box
5' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared, 13" col., gear box
5'-11" Carlton, m.d. on arm, latest
5'-13" Cincinnati-Bickford, m.d.
5'-14" American Triple Purpose, m.d. on arm
5' Cincinnati-Bickford Full Universal, gear box
5' Cincinnati-Bickford Plate Hole Driller, m.d. on arm
5' Prentice, m.d., Plain
6'-15" American Hole Wizard, m.d. on arm
6'-15" Carlton, gear box, inclosed head
6'-15" Cincinnati-Bickford, with 7' arm, m.d.
6' Niles-Bement-Pond Semi-Universal, m.d.
6'-10" Western, m.d.
7'-17" Groton, gear box, m.d.
8'-10" American Triple Purpose, m.d. on arm
10'-22" American Triple Purpose, m.d. on arm

UPRIGHT DRILLS

20" Barnes All Geared, m.d., tapper
21" Cincinnati-Bickford, m.d., tapper
24" Cincinnati-Bickford, m.d.
25" Foodick H.D., s.p.d.
25" No. 250 Cleereman, m.d., latest
30" No. 300 Cleereman, m.d., latest
32" Rich H.D., m.d.
04 Colburn H.D., m.d.
06 Colburn H.D., m.d.
No. 25 Foote-Burt, m.d.
No. 36HO Baker H.D., m.d.
No. 210 Barnes All Geared Self-Oiling Drill, m.d.
No. 217 Baker H.D., s.p.d.

GEAR SHAPERS

No. 0 Fellows, belt drive
No. 7, 7A Fellows, m.d.
No. 1B Fellows Gear Finishing Machine, m.d.
No. 6I Fellows, bolted m.d.
No. 6IA Fellows, m.d., latest type
No. 6MB Fellows, m.d.
No. 6I5A Fellows, m.d.
No. 645 Fellows, m.d.
No. 72 Fellows, m.d., latest
No. 75 Fellows, m.d.

GEAR GRINDERS

6x30" Fitchburg Hydraulic Spline & Gear Grinder, m.d.
9" Pratt & Whitney Hydraulic Spur, m.d.
10" Pratt & Whitney Hydraulic Spur & Helical, m.d.
No. 2NB Lees-Bradner Spur & Helical, m.d.
No. 13LB Fellows Gear Lapper, m.d.

BROACHING MACHINES

No. 4 Oil Gear Hydraulic, m.d., 60" stroke
75 H.P. LaPointe Horizontal Hydraulic, 100" stroke, 37½ tons cap.
Cincinnati Mill Branch, m.d., 10" spindles, new

BALL BEARING DRILLS

Model D 1100 B Walker-Turner Bench Type, 20" size, brand new
No. ½, 1, 2 Avey, belted m.d.
No. 1B Edlund, m.d., new
No. 3—42" Foote-Burt Single Spindle, m.d.
No. 2LMS Leland-Gifford, m.d., Deep Hole Drill, latest
No. 3 Allen, belted m.d., 12" overhang, No. 3 Taper
No. 4 Foodick, 8" overhang, belted m.d., No. 2 Taper
No. 4BM—24" Foodick, m.d., latest
No. 5M—16" Foodick, m.d.
1 spindle No. 3 Avey Type B, style MAS, m.d., No. 3 Taper, latest
2 spindle 28" Canedy-Otto, m.d., No. 4 Taper
2 spindle No. 3 Avey, belted m.d., p.t.
3 spindle No. ½ Avey, Heavy, direct m.d., latest
3 spindle Leland & Gifford, m.d. on each spindle, No. 3 Taper
4 spindle No. 2 Avey, belted m.d.
4 spindle No. 2LMS Leland-Gifford, 28" swing, m.d. on each spindle
4 spindle No. 2 MAS Avey High Speed, m.d. on each spindle, No. 2 Taper
6 spindle No. ½ Avey, Model MAS, m.d., latest
6 spindle Leland & Gifford, No. 2 Taper, m.d. on each spindle
6 spindle 2B Edlund, m.d., No. 2 Taper
6 spindle No. 3 Avey, belted m.d.
6 spindle No. 3 BEdlund High Speed, motor on each spindle
6 spindle Henry & Wright, m.d., 15" overhang, No. 2 Taper

HORIZONTAL DRILLS

Morris Horizontal Mor-Speed, m.d.
No. ½Bx30" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. ½Bx30" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. ½Bx50" Pratt & Whitney Chambering Machine, m.d., latest

We carry an average stock of 2,000 machines in our 11 acre plant at Cincinnati. Let us quote on your requirements.

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OUTSTANDING MACHINERY CLEARANCE

ALL BUILT NEW from 1942 to 1947

GENERAL PURPOSE TOOLS FROM BALL BEARING PLANT

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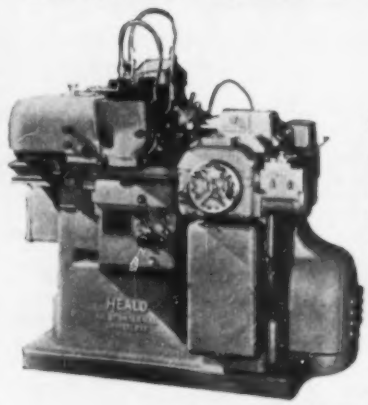

26—HEALD #81 Internal Centerless Grinding Machines, Hi-center and on-center, Gagematic and Sizematic, Complete with motors and coolant, New 1944.

- **CONOMATIC 2⅝", 6 spindle Automatic Screw Machine**
- **CONOMATIC 1⅝", 8 spindle Automatic Screw Machine**
- **ACME GRIDLEY 2" Model RAS, 6 spindle Automatic Screw Machine**
- **VAN NORMAN #620 Internal Radius Grinder**
- **EXCELLO #33 Thread Grinding Machine**
- **PHYSICIST Research Anderometer**
- **HOLDEN Salt Hardening Furnace**
- **CRUSHER for steel turnings**
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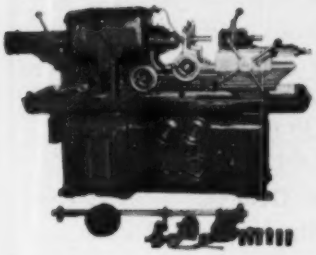


Simmons #2B, Geared Hd. Dial Type, Bar Feed 'Micro-Speed' Turret Lathe. 1¼" Capacity. Coolant System, Collets & Tooling.

TURRET LATHES

Bardons & Oliver #1 Electric Turret Lathe. ¾" cap. Has bar feed & collets.
Morey #2 Geared Head 1" Cap., M. Dr.
Simmons Microspeed 1" Cap., M. Dr.
W-Swasey #4 Univ. 1½" cap., M. Dr.
Jones & Lamson #3 Univ. Bar Feed 1½".
W-Swasey #3 Univ. 1½" cap., M. Dr.
Bardons & Oliver #7, Univ. 2½" Cap.
W-Swasey #3A Univ. 3½" cap., M. Dr.
Warner & Swasey #1A Universal Heavy Duty Saddle Type Turret Lathe. Serial #648220. Capacity —2½" rd., Gr. Hd. 12 speeds. Coolant system, bar feed, chuck & tooling. Immediate delivery.

PAPER SHREDDERS—NEW

Mitts & Merrill #10,600# per hour.
Mitts & Merrill #14,1800# per hour.
Excellent Condition, Immediate Shipment.

LATHES

14½"x6' South Bend Enclosed Head, Motor Driven.
36"x30' LeBlond Q.C.G. Hvy. Duty Grd. Hd.
26"x14' Lodge & Shipley Q.C.G. Taper.
25"x14' LeBlond, Taper Att. Motorized.
24"x8' Lodge & Shipley, Q.C.G. Motorized.
22"-46"x10' Q.C.G. Putnam Extension Bed Gap.
22"x10' LeBlond, Q.C.G. Motorized.
20"x18' American Q.C.G. Grd. Hd. Taper Att.
20"x10' Hendey Q.C.G. Taper Att. Motorized.
20"x10' American, Q.C.G. Motorized.
18"x8' Hendey, Q.C.G. Motorized
18"x6' American Q.C.G. Grd. Hd. Taper Att.
18"x6' Monarch Q.C.G. Grd. Hd. Motorized.
16"x8' Hendey Q.C.G. Taper Att. Motorized.
14"x8' Hendey, Q.C.G. Taper Att. Motorized.
14"x8' Reed-Prentice Grd. Hd. (REBUILT)
14"x7' Hendey Q.C.G. Motorized.
14"x6' Hendey Q.C.G. Taper Att. Motorized.
12"x6' Hendey Q.C.G. Taper Att. & Equipment.
12"x5' Hendey Q.C.G. Taper Att. & Collets.
11"x3' South Bend, Q.C.G. Motorized.
10"x24" Logan Q.C.G. #825—(NEW)
10"x24" Logan Q.C.G. #820—(NEW)
10"x20" #EE Monarch Toolmakers
9"x15" Porter-Cable Grd. Hd.

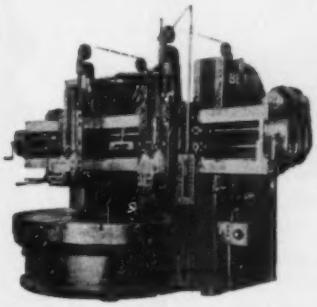
GRINDING MACHINES

Blanchard #16 Motor Driven Vertical Rotary Surface Grinder. 26" Chuck with power down feed.
Cincinnati 10"x36" Plain Hydraulic Cylindrical Model #EA. Serial #5P2D1L-19. Filmatic Bearings. Built-in Electrics. Hydraulic Infeed.

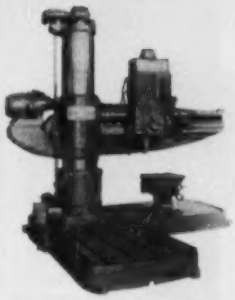
Cincinnati #2 Cutter & Tool Grinder. New in 1943, Equipment includes Motor Driven Cylindrical Grinding Attachment.

BORING MILLS

3⅛" bar Giddings & L. Horiz.
5" bar Barrett #2 Cylinder.
8" bar Barrett #6 Cylinder.
Ryerson #11 Horiz. 3" Capacity, #6 M.T.
24" Bullard Vertical, Motorized.
42" Bullard Vertical, Motorized.
54" Bullard Vertical, Motorized.
42" Gisholt Vertical, Motorized.



Betts 100" Vertical Boring & Turning Mill. 1946 machine. 2 plain heads. Complete Electrical Equipment. Excellent condition.



Cincinnati-Bickford 6'-19" SUPER-SERVICE Radial Drill. New in '42. Standard base plus angle base. 36 spindle speeds. Necessary motors & controls & universal table.

RADIAL DRILLS

Cinci-Bickford 6' Arm, 15" Col. Speeds.
Cinci-Bickford 5' Arm, 13" Col. 24 Speeds.
Cinci-Bickford 3' Arm, 9" Col. 12 Speeds.

Van Norman #3V Ram Type Vertical Mill. Late Type. 18 speeds. Range: 34"x12"x 18". 14" ram travel. Power Rapid Traverse all ways. Motors and Controls.

MILLING MACHINES

Milwaukee #2B Dble. Overarm, Horiz.
#3 Dial Type, H.S. Cincinnati Vertical Mill.
#2, #3, #4 Cincinnati High Power Vert.
#4-36 Cincinnati 4-Spdle. Duplex Hydromatic.
#4-36 Cincinnati Plain Hydromatic.
Sundstrand #0 Hydraulic Feed Rigidmill.
Cincinnati #0-8 Automatic Horizontal.
Cincinnati #0-8 Vertical.
Cincinnati #2-18 Automatic Horizontal.
Brown & Sharpe #12 (Electrics Built-in) 24".

UNIVERSAL MILLING MACHINES

B & S #2, 20"x5"x17½".
B & S #1½, 20"x7"x18".
Bridgeport, 20"x9"x16" Turret Type.
Garvin #2MU, 24"x8"x18".
Kempsmith #2, 28"x8½"x18".
Cincinnati #2M, 28"x10"x18".
B & S #3, 34"x10"x21".
Cincinnati #3S 34"x12"x20".

PUNCH PRESSES

O.B.I. Toledo #5, 44 tons cap. motor dr.
O.B.I. Bliss #18, 19C, 20, 20B, 21 motorized.
O.B.I. Michigan, 36 tons cap. Wide ram & bed.
#68C Bliss Dble. Action 3-Crank.
#91C Toledo Sgle. Act. Dble. Crank S.S.
#305 Bliss S.S.S.A. 95 tons Cap.
#3A Bliss S.A.S.S. Dble. Crank. 42 Tons.
Zeh & Hahneman 35 Tons S.A. Cam Release Spring Return. 220/440 motor.

NEW 80 PAGE CATALOG MAILED FREE UPON REQUEST

EMERMAN OFFERS FROM STOCK

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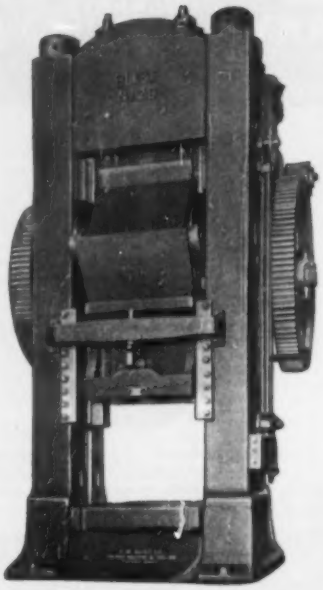

TOLEDO KNUCKLE JOINTED COINING PRESSES---667---668

CAPACITY . . .	1200 TONS	. . . 1500 TONS
STROKE . . .	5 "	. . . 6 "
DIE SPACE . . .	33½ "	. . . 36½ "

DOUBLE BACK GEARED

Pneumatic Operated Friction Clutch
Equipped with Two Station Air Operated Dial Feed
— Bottom Lift Out — And Air Operated Pickoff

Also: 27 K Bliss Coining.
78 Toledo Permanently inclined (2).
#2719—800 Ton Hamilton Press.
486 Hamilton Double Crank.
40-T-6 Minster with side shear.

EMERMAN MACHINERY CORP.

870 W. 120TH STREET *CHICAGO 43, ILLINOIS*

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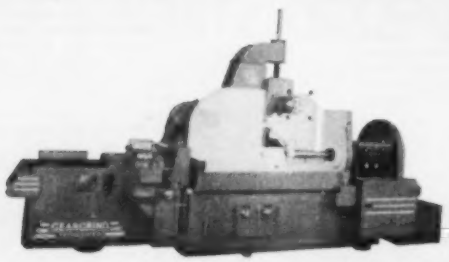

GG-24-48 Gear Grinding Machine Company. Gear Grinder with hydraulic drive to grinding wheel carriage, index mechanism and trimmer. Capacity between centers 48". Diameters 2½" to 24" and up to 24" face. Late type.

Write today for a complete stock list of Simmons Engineered-Rebuilt Machine Tools.

SIMMONS MACHINE TOOL CORPORATION

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UNUSUAL VALUES

Milling Machines—No. 1 Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 3—26" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Planer type 16"x36" Surface 12"x15", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x6', 8', 10'—16"x8', 3', 10'—18"x8', 5', 10'—26"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 12" and 18" bench and floor type.

Planers—Single head 24"x8', 24"x8', 30"x8'.

Shapers—16", 20", 24" B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 2" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

THE OSBORNE & SEXTON MACHINERY CO.

P. O. Box 88, Columbus 16, Ohio

LATEST TYPE *Nearly New* MACHINES

BORING MILLS—Horizontal
CINCINNATI GILBERT 3½" bar, floor type, latest
DETRICK & HARVEY 4" bar, Floor Type, M.D.
DETRICK & HARVEY #287, 2½" bar, Latest Type
GIDDINGS & LEWIS #287, 2½" bar, Latest Type
HEALD 46, 49 single end, Borematic, Latest
LANDIS—#250—3½" bar, floor type, M.D.
LANDIS—#250—3½" bar, floor type, Latest Type
LUCAS #41, 3" bar, Table Type, Late Type
LUCAS #43, 3" bar, Table Type, M.D.
NILES-BEMENT-POND 3", 3½" bar, Floor Type, M.D.
UNIVERSAL 3" bar, high speed, latest type

BORING MILLS—Vertical
BULLARD 16" 6-spindle Mult-Au-Matic Type D, Latest
BULLARD 12" 6-spindle Mult-Au-Matic Type D, Latest
BULLARD 24" 36" Turret "New Era" Side Head, M.D.
BULLARD 24", 36", 42" Vert. Turret "Spiral Drive" High Speed, Latest Type
COLBURN 72", 2 swivel heads, PRT, M.D.
KING 62", 2 swivel heads, PRT, M.D.
NILES 100", 2 swivel heads, Rapid Traverse, AC M.D.

BROACHES
AMERICAN V-2, 5 ton Hyd., Latest Type
CINCINNATI 1-20, 2-30, Duplex Vertical Surface, Hyd., Double Ram, Model EB, Latest Type
LaPOINTE 5-36 Vertical, Hyd., Latest Type

DRILLS—Miscellaneous
BARNES H-3 "Hydram," Hydraulic, 3" capacity—for inverted drilling, Latest Type
CINCINNATI BICKFORD 21" Box Column, Latest
CINCINNATI BICKFORD #1LMB, 4 Spindle, Latest Type
LELAND & GIFFORD #1LMB, 4 Spindle, Latest Type
LELAND & GIFFORD —2, #2MB, Single Spdle.
LELAND & GIFFORD #2LMB 3 and 4 spindle, Latest
LELAND & GIFFORD #2LMB 3 and 4 spindle, Latest Type
NATCO #4AL Multiple, 36 spindles, HYD., Latest Type

DRILLS—Deep Hole
BARNES 420/2 Spindle Hydraulic, Latest Type
LeBLOND #3 Single Spindle, Hydraulic, Latest Type
PRATT & WHITNEY #11B36", Hyd., Latest Type

DRILLS—Radial
AMERICAN 4' arm 11" col. "Hole Wizard," Latest
AMERICAN 4' plain Triple Purpose, Motor Drive
AMERICAN 5' arm 15" column Plain, M.D.
CINCINNATI BICKFORD 5'13" arm, Plain, M.D.
CIN. BICKFORD 5' arm 15 col. Plain or Univ., M.D.
CIN. BICKFORD 5' arm 15" column Univ., M.D.
DRESSER 5' arm 15" column Plain, Latest Type
WESTERN 6' arm 20" column Plain, Latest Type

GEAR CUTTING EQUIPMENT
BARBER COLMAN #12 Hobber, Single and Double Overarm, Motor Drive
BROWN & SHARPE 6-60 Gear Cutter, Motor Drive
BROWN & SHARPE #13 Spur and Bevel Cutter, M.D.
BROWN & SHARPE #13 Hobbing Machine, Motor Drive
CROSS #1 Tooth Rounding Machine, Latest Type
CROSS #50 Universal Gear Chamferer, Latest Type
FELLOWS 61, 61A, 65A3, 622, Model 7, 7A, 7, 72, 725, 77 High Speed Gear Shaper, Latest Type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #13L5 Lapper, latest type
FELLOWS 8M Red Liner, Latest Type
FELLOWS #13L5 Lapper, latest type
GLEASON #14 Hypoid Spiral Generator, Latest Type
GLEASON 12" Straight bevel generator, latest type
GLEASON #1, #6, #16 Bevel and Hypoid Gear
GLEASON #4, #7, 90° Straight and Bevel Gear Planer, Motor drive
GOULD & EBERHARDT 12H Hobber, Latest Type
GOULD & EBERHARDT 96H Hobber, with #6K, M.D.
PRATT & WHITNEY 10" Grinder, hyd., latest
SCHUCHARDT & SCHUTTE #1 Hobber, Motor Drive

GRINDERS—Cyl.—Plain & Univ.
BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
BROWN & SHARPE #5 Plain, 3 x 12, Latest Type
BROWN & SHARPE #6, Plain Hyd., Latest Type
LANDIS 4x12, Type E, Plain Hyd., Latest Type
LANDIS 6"x18" Type C Plain, Hyd., latest type
NORTON 6"x18", 6"x36", 14"x36", 10"x72" Type C, Plain, Latest Type

GRINDERS—Miscellaneous
BARBER COLMAN #2, #4 Hob Sharpener, Latest
BROWN & SHARPE No. 12 Univ. Cutter & Tool, Lat.
BROWN & SHARPE No. 24—26", Internal, Hyd., Latest
BRYANT #16-CP-16, #24—26", Internal, Hyd., Latest
CINCINNATI #2, #4, Centerless "Filmatic", Latest
CINCINNATI #3 "Monoset" Tool & Cutter, Latest
CINCINNATI "Monoset" Tool & Cutter, Latest
FITCHBURG 14"x25" Spline, hydraulic, latest
GARDNER 24-58" Disc Grinder, Latest
GLEASON #12 tool sharpener, Latest Type
HEALD 72A3, 72A5 "Gagematic," Internal, Latest
HEALD 75A, 72A3, 72A5, 74, 76A Internal, latest

HEALD #81 Internal Centerless, Latest Type
JONES & LAMSON 6x15, 8x48 Auto Thread, latest
LANDIS #6, 6x24 Thread, Latest Type
LANDIS #13 Centerless, Hydraulic, Latest Type
THOMPSON 6"x36" Auto., recond brush, M.D.
VAN NORMAN #673, #690, #698, #75 Oscillating Radius Grinder, Latest Type
VAN NORMAN #900 Crankshaft ReGrinder, Latest

GRINDERS—Surface
BLANCHARD #11, 16" dia. mag. chuck, Latest
DO-ALL Model C-7, 9"x20", Hyd., Latest Type
DO-ALL Model C-7, 9"x20", Hyd. Feed, Motor Drive
BLANCHARD 16A Vertical, Dial Feed, Motor Drive
BLANCHARD Series 20B 12"x48" Vert. Hyd., Latest
HANCHETT Series 20B 12"x48" Vert. Hyd., Latest
HANCHETT #26 Vert., 30" dia. mag. chuck, Latest
HANCHETT #120, 30x120" Plano, Hyd., Horiz., Latest
HANCHETT #120, 30x120" Plano, Hyd., Horiz., Latest
HEALD #22 Rotary, 12" chuck, latest type
HEALD 83A—rotary—16" and 36" chuck, Hyd., Latest
NORTON 6x18 Hydraulic, latest type
THOMPSON 12x12x24 Type D Hyd., Latest Type

JIG BORERS
KEARNEY & TRECKER Model B, Automatrie, Latest
PRATT & WHITNEY 1A, Motor Drive

LATHES—Engine and Mfg.
AMERICAN 26"x96" centers, 2 carriages, motor drive
BRIDGEFORD 20"x32" bed—2 carriages, M.D.
HENDEY 12x30" Timken, Latest Type
JONES & LAMSON "Fay" 20x25", 24x24 autom., latest
LeBLOND 21"x66" Centers, TIMKEN, latest type
LEHMANN 16x30" centers, TIMKEN, Latest
LODGE & SHIPLEY 16"x10", 14"x30" Timken, Latest
LODGE & SHIPLEY 16x72 centers, M.D.
LODGE & SHIPLEY 16x72 centers, 8x16, 8x24, Latest
LOEWING 4x60, 4x84, 8x60, 8x168, 8x24, Timken, latest
MONARCH 10"x20" centers, Model EE, Timken, lat.
MONARCH 12"x30" Centers, Model CKE, Timken, lat.
MONARCH 12"x54" Centers, Model CK, Timken, latest
MONARCH 16"x30" Centers, Model CW, Latest
MONARCH 22"x120" Centers, 2 Carriages, Timken Bearing, Model CM, Motor Drive
MONARCH 24"x54" Ball Bearing, Geared Head, M.D.
MONARCH 24"x54" Ball Bearing, Geared Head, Latest
NILES 30"x50" Boring "Toolmaker" Timken, Latest
PRATT & WHITNEY 10"x20" centers, Timken, latest
PRATT & WHITNEY 10"x20" centers, Bausch, latest
PRATT & WHITNEY 10"x20" Centers, Motor Drive
PUTNAM 42"x25" Centers, Motor Drive, Model A, Latest
REED PRENTICE 20"x54" Centers, Model A, Latest
SPRINGFIELD 16"x36" centers, Timken, latest type
WARD, HAGGAS & SMITH—18/30x66" centers sep. motor drive, Latest Type

LATHES—Hob and Cutter Relieving
MICHIGAN 1708 Universal, Latest Type
MICHIGAN 1712 Universal, Latest Type
U. S. TOOL #318B, Latest Type

LATHES—Turret
BARDONS & OLIVER #5, #7, TIMKEN, Latest Type
CINCINNATI ACME No. 1 Timken, Latest
FOSTER #4FU "Fastermatic," Timken, Latest
GISHOLT #1L, #3L, #3L Universal, Timken, Latest
GISHOLT #1L, #3L, #3L Universal, Timken, Latest Type
GISHOLT #3, #4 univ., TIMKEN, Latest Type
JONES & LAMSON #2 Univ., #5 Univ., Timken, Latest
LIBBY "International" 1H5 Univ., Timken Bearing, latest
MOREY No. 20, No. 3, No. 4, Timken Bearing, Latest
POTTER & JOHNSTON #5DDE, Timken, Latest Type
WARNER & SWASEY 5, Universal, Timken Bearing
WARNER & SWASEY #2, #3, Timken, Latest type
WARNER & SWASEY #1A, Univ., Timken, M.D.
WARNER & SWASEY #1A, Universal, Timken Bearing
WARNER & SWASEY 2A Universal, Latest Type
WARNER & SWASEY "Pre-selector" Bar and Chucking, Timken Bearing.
WARNER & SWASEY 3A Universal, Timken Bearing Bar and Chucking, Latest Type

MILLING MACHINES—Mfg.
HALL Style L, Planetary, latest type
INGERSOLL 42"x36"x12" adj. rail, 4 heads, AC, M.D.
INGERSOLL 32x24x16" Planer Type, 2 heads, AC, M.D.
INGERSOLL 30x24x12" adj. rail slab, M.D.
SUNDSTRAND Model 3A Duplex 42" feed, Latest
TAYLOR & FENN M30 Duplex Spline, latest

MILLING MACHINES—Plain
BROWN & SHARPE #3, Light Type, Timken, Latest
BROWN & SHARPE #12, 54" feed, Latest
BROWN & SHARPE #000, Timken, Latest Type
BROWN & SHARPE #2B, 2B, Timken, Latest Type
BROWN & SHARPE #2B, Automatic, Latest Type
CINCINNATI 0-8, 1-12, 2-18, Automatic, Latest Type
CINCINNATI #3, #4, #5 High Power, Latest Type
CINCINNATI 4-36 Hydromatic, Simplex, Latest Type
CINCINNATI #2H, 2H, 4H, 5H, Latest
KEARNEY & TRECKER #2H, 2H, 4H, 5H, Latest
KEARNEY & TRECKER #2, #3, Timken, Latest Type
KEARNEY & TRECKER 1218, 1404, Simplex, Latest
KEMPSMITH #2D, #3, Timken, Latest Type
KEARNEY & TRECKER 4K, Timken Bearing, Late

MILLING MACHINES—Thread
LEES BRADNER Model LT, 6"x36" Centers, Latest
LEES BRADNER Model HT, 13"x54" Centers, Latest
MOREY 12x36", 60°, 120°, 180° centers, Latest Type

MILLING MACHINES—Universal
BROWN & SHARPE No. 2A, Timken Bearing, Latest
BROWN & SHARPE No. 3A, 4A, Motor Drive
BROWN & SHARPE 2H, Timken, Latest Type
KEARNEY & TRECKER 2H, Timken, latest type
KEMPSMITH #4 Maxi-miller, Timken, latest type
KEMPSMITH #3 duplex, Motor Drive
VAN NORMAN #3 duplex, Timken, Latest Type
VAN NORMAN #12, #26, #36, Timken, Latest Type

MILLING MACHINES—Vertical
BROWN & SHARPE #2 Standard Timken, Latest
BROWN & SHARPE #4, Dial Type, Timken, Latest
CINCINNATI #2, Dial Type, Timken, Latest
CINCINNATI #2, TIMKEN, Latest Type
CINCINNATI #4, Super-Speed, Latest Type
GORTON 6D, 6½D, Super-Speed, Timken, Latest Type
KEARNEY & TRECKER 2H, 3H, Timken, Latest Type
KEARNEY & TRECKER #3K, Timken, Latest Type
KEARNEY & TRECKER 4 Double Spindle Profiler, Latest
MOREY 12M Single & Double Spindle Profiler, Latest
MOREY 12M Single & Double Spindle Profiler, Latest
REED PRENTICE 3VG, with or without hydraulic duplicator, Timken bearing, Latest Type

PLANERS
BETTS (CONSOLIDATED) 84"x84"x18' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
BETTS (CONSOLIDATED) 108"x84"x36' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
CINCINNATI 36"x36"x12' 4 heads, PRT, DC, M.D.
DETRICK & HARVEY 60"x60"x12' 4 heads, Hydraulic, Rapid Traverse, A.C. Motor Drive
NILES 108"x84"x42" 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
NILES 42"x42"x14' "Spring Barrel" Box Table, 3 Heads, PRT, VARI-VOLTAGE Drive, Latest

PRESSES
BIRDSBORO 325 ton, vert. hyd., Latest Type
BLISS 75-35 Hydro-Dynamic, Double Action, Latest
GLEASON 15" Gear Shaping, Hyd., Motor Drive
HENRY & WRIGHT 50 ton Dieing, Roll Feeds, M.D.
LAKE ERIE 500 ton Vert., Hyd., Latest Type
NILES 400 ton, Horiz. wheel, Motor Drive
UNITED ENG. 500 ton, Vert., Hyd., Latest

SCREW MACHINES—Automatic
ACME GRIDLEY 2" Model RAS, 6 spindle, Latest
CLEVELAND 9/16", 11/16" Model A, Latest Type
CONOMATIC 1¾", 6 spindle, High Speed, Latest Type
CONOMATIC 2½", 6 spindle, high speed, Latest Type
GOSS & DeLEEUW 6"x2¾", 5 spindle Chucker, Two rotating, Latest Type
GOSS & DeLEEUW 6" 5 spindle Chucker, Work Rotating, Latest Type

SHAPERS & SLOTTERS
AMERICAN 20" Heavy Duty, Motor Drive
DILLE 26"-34" Vertical, Motor Drive
GOULD & EBERHARDT 20", 22", High Duty, M.D.
PRATT & WHITNEY 6" Vertical, M.D.
SMITH & MILLS 16" high speed, latest type

SHEARS—Power
WYSONG & MILES #572, 14 gauge x 6', Latest Type
QUICKWORK #5, ¾" Cap., Rotary Shear, M.D.
QUICKWORK #6, 1" Cap., Rotary Shear, M.D.

MISCELLANEOUS
AJAX 2", 3½" Forging and Upsetting, M.D.
BAKER #5 Keyseator Motor Drive
BARNES #172, 200H, 201, 201H Vertical Hone, Hyd.,
Self-Oiling, Latest Type
CAMPBELL #401 Abrasive Saw, Latest Type
DE LAVAL #194 Coolant Clarifier, Latest
LANDIS 2" Single & Double Spdle. Bolt Threader, M.D.
MANVILLE #D 1/16" Cap. #58D, Hell Hender, M.D.
NAZEL #4B Pneumatic Hammer, M.D.
NORTON #2F 10U Vertical Lapper, Latest Type
PRATT & WHITNEY (KELLER) Type BL-3416, Type G, Copying, 2 and 3 dimensional, Latest Type
PRATT & WHITNEY #6 B 50 Miller, Latest Type
ROWBOTTOM Cam Miller, Motor Drive
VERSON #200 10 gauge x 96" Press Brake, Latest

WATCH THIS PAGE!

For MODERN high quality machine tools nearly all built new since 1941. These tools are priced well within your equipment budget. *Wire, write or phone for pictures, details and prices, today.*

NILES 60"x55' Centers "Time Saver" Heavy Duty Engine Lathe—2 carriages, Power Rapid Traverse with each carriage, Latest Type (NEW 1943)

Most Built After 1941

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(Partial List) Over 2,000 Machine Tools in Stock. Your Inquiries Are Invited . . . Prompt Service is Assured

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CHECK THIS LIST OF FINE TOOLS

AUTOMATICS

½", No. 0G Brown & Sharpe
9/16" Acme Gridley model B6
⅞" & 1¼" Cone 4 spindle
1⅛" Cleveland 4 spindle
1⅛" Greenlee 6 spindle
1½" New Britain 6 spindle
1⅞" Conomatic 6 spindle
2"x18" Cleveland model B
2⅛" Acme Gridley model RA6
6" Bullard Multamatic
No. 2 FU Foster Fastermatic
No. 16 New Britain 6 spdl. chucker
14"x18" Fay chucker
No. 5DE2 Potter & Johnston

BROACHES

10 ton 36" stroke Colonial duplex surface
15 ton 36" stroke American duplex surf.
No. 1 Foote Burt duplex surface
2 ton American horiz. hydraulic
No. 3 Oilgear horiz. hydraulic
No. 10-72 Colonial horiz. hydraulic
No. 2 Lapointe screw type
10"x72" Colonial broach sharpener

DRILLS, MULTIPLE

42 spdl. No. B 16 Natco
34 spdl. No. 30 Natco
24 spdl. No. B4A Natco
22 spdl. No. 14 Natco
18 spdl. No. 2 BL Natco
12 spdl. No. 30 Natco rail
12 spdl. No. 25 Baush rail
8 spdl. No. 11 Natco

GRINDERS

No. 72A3 Heald Sizematic internal
No. 72A3 Heald Sizematic centerless
Nos. 72A3, 72A5 & 74 Heald plain
No. 75A Heald hand feed
Nos. 16A16, 16-28, 16-30, 16CP16 & 24-36 Bryant
Model MH Sav-way hydraulic
Size 1C Gremby internal
No. 2 Cincinnati centerless
No. 10 Blanchard surface
Nos. 3 & 34 Abrasive surface
8"x24" Wilmarth Marmon surf.
12" & 18", No. 22 Heald rotary surf.
18" & 24" No. 25A Heald rotary surf.
No. 3 Norton universal tool
Model 4T Sellers tool
No. R8 Pratt & Whitney tool
No. 51 & 510 Oliver drill
No. 10G Sellers drill
Nos. 33 & 35 Excello thread

LATHES, TURRET

Model 6-2 Denver
Nos. 2 & 3 G Morey
No. 4 Midland
Nos. 5 & 7 Bardons & Oliver
No. 3 Jones & Lamson
No. 5 Foster
Nos. 2, 3, 4, 1A & 3A Warner Swasey
Nos. 3, 4, 5, 3AL & 28" Gisholt
24" & 36" Bullard vertical
No. 2 FU Foster Fastermatic
3"x30" & 4"x34" Jones & Lamson

MILLERS

No. 2H Kearney & Trecker univ.
No. 3 Cincinnati universal
Nos. 2AS & 3B Milwaukee plain
Nos. 2, 3 & 4 Cincinnati vertical
Nos. 2H & 3H Kearney Trecker vert.
No. 3V Van Norman vertical
No. 3 Kempsmith Maximill vert.
Nos. 1-12, 1-18, 2-18 & 2-24 Cint. auto
Nos. 0-8 & 2-18 Cint. Rise & Fall
Nos. 3-24, 34-36, 4-36, 4-48, 5-48, 56-72 and 56-90 Cincinnati Hydromatic
Nos. 1M-12", M18, M24 & 12-24 Kearney & Trecker
50", 42" & 84" Ingersoll Rotary
Nos. 4, 6, CT38 & 40 Lees Bradner thread

PRESSES

1000 ton Southwark hydraulic
1000 ton No. 668 Toledo coining
600 ton No. 2318½ Hamilton forging
350 ton No. F1350-42 clearing
48", No. 93½ Toledo double crank

MILES MACHINERY CO.
SAGINAW, MICH.

MAN HOUR *Savers*

BORING MILLS

Universal 4" bar "Tri-Way," face plate to outer support 72", #6 taper, added vertical range (late).
Defiance 2¾A, 3¾" bar, face plate to outer support 72", #6 taper, added vert. and cross range (late).
Lucas #41, 3" bar, face to outer support 72", #5 taper. (late).

VERTICAL

Bullard 24' and 36", "spiral drive" and "new era" type, vertical. 3-jaw and 4-jaw chuck tables.

VERTICAL MILLERS

Brown & Sharpe #2 Lite Type, wkg. table 45"x10", range 28"x18"x10", late.
Milwaukee #2K and #3K Hi-spd. (very late).
Cinn. #3 Dial Type, med. spd., wkg. surface tbl. 62½"x15¼": range: long. 28"x16"x6".
Knight #4 motor-in-base, wkg. surface tbl. 12"x39"; power feed all direc. arrngd. for jig boring with verniers.

TURRET LATHES (Late Type)

Warner & Swasey #3, 1½" cap., #4, 2" cap. ram type Universal bar and chucking, tooling.
Jones & Lamson #5, 2½" cap. ram type Universal, rpd. trav. to cross slide, bar and chucking.
Gisholt #5, 2½" cap., ram type Universal, Preselec. hd., thread, attchmt., bar and chucking, tooling.

AUTOMATIC SCREW & CHUCKING MACHINES

B. & S. #2G Hi-spd. auto. ⅞" cap. 2189 max. rpm. (late).
B. & S. #6 auto. motor-in-base 2½" hole, 505 max. rpm.
Nat'l Acme RA 9/16", spdls. 6, 2885 max. rpm, tooling and attachments (very late).
Cleveland 3¼" model A spl. spdl. auto. screw, quantity of tooling (very late).

LATHES

Lodge & Shipley 14"x6' and 8'—12 spd. sel. gr. hd. 33½" C.D. Attchmts. Motor-in-base.
American 16" x 126" centers 12-spd. Hi-duty gr. hd., 18½" swing, motor-in-base, rpd. trav., Timken brg.
Monarch 20"x72" centers model M, 16 spd. gr. hd. 22½" swing, Monarch auto. sizing control (late)
Lebland 33"—60" sliding gap lathe, 9' 2" C.D. Gap closed, 14' 2" C.D. gap extended.

MISCELLANEOUS

(new) Rafter All-Steel Power Squaring Shears, available in two sizes, ¼" x 10' mild steel, ⅛" x 10' stainless steel; 3/16" x 12' mild steel, 3/32" x 12' stainless steel, stock delivery.

This Is Only a Partial Listing.
Send for Our Catalog

Botwinik Brothers

PRACTICALLY NEW

Model #150 Defiance Hydraulic Horizontal Boring, Drilling and Milling Machine, Table Type.

5" diameter bar, quick change feeds and speeds, length of bed 10', working surface of table 48" x 84", Serial No. 1606-42, Mfg. in 1942.

PRICE **$17,500.00**

WILL TRADE FOR OLD STYLE CONE DRIVEN MACHINES.

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WINSTON MACHINERY CO., INC.
517 S. Delaware St., Indianapolis 4, Ind.

McDONALD
USED MACHINERY

Colburn 62" Hvy. Duty Vertical Boring Mill
G & L and Universal 3" Bar Horiz. Boring Mills
Dreis & Krump 10' Press Brake, No. 14—Ga. M.D.
Campbell 6" Cap. M.D. Abrasive Cut-Off Mach.
Moline 6-Sp. Hole Hog Drill, Barnes 4-Sp.
20" All Grd. Camel Back Drill
Cin-Bick 3' & Morris 3½' Arm Radial Drills
Do-All 8 x 24" Horiz. Sp. Hyd. Surface Grinder
Blanchard M.D. Vert. Sp. Surface Grinder 20" chuck
L. & S 20" x 8', 18" x 12', 20" x 10', 28" x 12'
Axelson 20" x 12', Hendey 14" x 6', Amer. 17" x 8'
Monarch 20" x 8', Amer. 20" x 12' grd. hd. q.c.g. m.d. Engine Lathes
B & S Nos. 2-B & 3-B, Cin. No. 3 Mil, No. 2-B & 3-B, Cin. No. 5, LeBlond No. 4, Grd. Hd. Plain Millers
B & S No. 2-A & 3-A, Mil. No. 2-B, Cin. No. 1-M, Cin. No. 2, Grd. Hd. Univ. Millers
Cin. 36" M.D. Univ. Shaper, G & L & Amer. 24" Shapers
Cleveland 48" x 12' Table Open-side Planer, 3 Hds.

McDONALD MACHINERY CO.
1531-35 No. B'way., St. Louis 6, Mo.

UPSETTER

2"-Acme with V-Belt Drive 15 H.P. Motor

ALLIGATOR SHEAR

3" Round Capacity, 30" Blade No. 3
THOMAS CARLIN & SONS

GEAR CUTTER

84" Newton 1¼ D.P.

TOLEDO MACHINERY MART
6225 Benore Rd., Toledo, Ohio

MACHINERY FOR SALE

ATTENTION EXPORTERS!

Unusual opportunity to procure modern Fellows Gear Shapers 615A and 645 as well as 12" Gleason Generators, 36 BM Gould & Eberhardt Rougher, #7 Fellows Gear Shaper, #16 D. E. Whiton Machine. Write for full information.

FB-1683, AMERICAN MACHINIST
330 W. 42 St., N. Y. 18, N. Y.

PLANER FOR SALE

DETRICK & HARVEY 60" x 60" x 18' openside planer, with two rail heads and one side head. Serial No. 827.
Price **$4,000.00**

Excellent Condition

WINSTON MACHINERY CO., INC.
517 So. Delaware St., Indianapolis 4, Ind.

FOR SALE

KINGSBURY 8 SPINDLE DRILLING AND TAPPING MACHINE. New Condition. Price about 1/3 new cost.
1—2¾" 6 ACME GRIDLEY #84326 about $8,000.00 extra tooling.

ROBERTS SCREW PRODUCTS
4525 Penn Avenue S., Minneapolis 9, Minn.

USED MACHINERY FOR SALE

1—16" Columbia Back Geared Shaper, motor driven, complete with all standard equipment. Price—$600.
1—6" Gleason Bevel Gear Generator. Serial #4303.
1—Lapointe Horizontal Twin Broach, No. 3.

MR. WARNER, LIBERTY PLANERS, INC.
HAMILTON, OHIO

FOR SALE

2 1" 6 Spindle Greenlee Automatics

New in 1945 & 1941. Excellent condition. 15 HP, 220/440 V, 3 Phase 60 cycle motors under power. Tooling.

KAMINGA MANUFACTURING CO.
1444 Chicago Dr. Grand Rapids, Mich.

LATE TYPE MACHINE TOOLS

AUTOMATICS
6" RPA-8 Acme-Gridley Chucker. 1941.
16" Bullard Mult-Au-Matic, 6 & 8 spdl. 1944.
2⅝" RA-6 Acme-Gridley, 6 spindle. 1943.
1⅝" Greenlee, 6 spindle. 1942.
9/16" RA-6 Acme-Gridley. 1942.

BORING MACHINES
No. 42 Lucas Horizontal. 1940.
No. 54 Excello Double End. 1940.
No. 46B Heald Single End. 1940.

DRILLS
3'9" "Mor-Speed". Latest.
25" Foedick "Economax." 1941.
No. 217 Baker, box column. 1942.
No. 5 BM Foedick, box column. 1942.

GEAR EQUIPMENT
3" Gleason Generator. 1941.
No. 6 & 17 Gleason Testers. 1943.
12" Red Ring Internal Shaver. Late.
No. GCL Red Ring Shaver. 1942.
No. 624A3 Fellows Side Trimmer. New.
No. 615A & 61A Fellows Shapers. 1943.
No. 7125A & 712 Fellows Shaper. 1943.
Vinco Spline & Gear Grinder. 1942.

GRINDERS, CYLINDRICAL
25" x 48" Landis, Crankshaft. Like New
16" x 36" Cincinnati Plain. 1942.
12" x 48" Cincinnati Univ. 1943.
10" x 72" Landis Plain. 1942.
10" x 18" Norton Plain. 1942.

GRINDERS, INTERNAL
No. 74 Heald Ext. Bridge. 1941.
No. 72A3 & A5 Heald Plain. 1944.
No. 5 & 16A22 Bryant. Latest.

GRINDERS, SURFACE
No. 18 Blanchard, 36" Chuck. 1942.
12" x 16" x 60" Thompson Hyd. Latest.
No. 22 & 25A Heald Rotary. 1943.

LATHES, ENGINE
45" x 192" Axelson. 1942.
24" x 168" Sidney. 1942.
18" x 54" Lodge & Shipley. 1943.
18" x 48" Bradford. 1942.

LATHES, PRODUCTION
Gisholt "Simplimatic." 1940.
No. 3A L&S "Duomatic." 1943.
No. 2FU Foster "Fastermatic." 1943.
8" x 108" Lo-Swing Semi. Auto. 1942.
Model 8, 10 & 12 Sundstrand. 1942.
14" x 42" Monarch "Magna-Matic." 1941.
20" x 25" Fay Automatic. 1942.

LATHES, TURRET
36" & 42" Bullard Vertical. 1943.
No. 2A & 3A Warner & Swasey. 1943.
No. 1 & 8½" x 24" Acme Univ. 1943.
No. 2, 3 & 4 Warner & Swasey. 1943.
No. 2, 3, 5 & 7 Bardons & Oliver. 1942.

MILLS, PLAIN
No. 5 Cincinnati. 1943.
No. 4H & 4K Milwaukee. 1943.
No. 3B Brown & Sharpe. 1941.
No. 3 Van Norman. 1942.
No. 2HL Milwaukee. 1942.

MILLS, PRODUCTION
BL-2416 P&W "Keller," 1 sp. 1943.
BG-1 Keller, single spdl.
No. 2-20 Kent Owens. 1942.
No. 1224 & 1248 Milwaukee. 1943.
No. 3-26 Cincinnati Duplex, R & F. 1942.
No. 1-18, 2-18 & 2-24 Cincinnati. 1942.

MILLS, THREAD
6" x 60" Pratt & Whitney. Latest.
12" x 54" Lees Bradner. 1943.
4" x 9' Hanson Whitney. Late.

MILLS, UNIVERSAL
No. 2MH Cincinnati. 1942.
No. 2H Milwaukee. 1942.
No. 2SU & 26SU Van Norman. 1942.

MILLS, VERTICAL
No. 3B P&W Univ. Die Sinker. 1943.
No. 2K & 3H Milwaukee. 1942.
No. 2 & 3 Cincinnati. 1942.
No. 1 Cleveland. 1942.

PRESSES
No. 40-5½ Minster. 1942.
100 Ton Hannifin, Hyd. Str. 1942.
50 Ton Denison. Hyd. Str. 1942.

INDIANAPOLIS MACHINERY & SUPPLY CO.
1961 S. Meridian St.
INDIANAPOLIS 6, IND.

A PARTIAL LIST OF LATE MODELS

AUTOMATICS
Brown & Sharpe #00G, H.B., #4, #6
Conomatic 6 sp. 1⅞" cap., CECO ⅝"
Fay 12"x90"
New Britain Gridley 6i—6 Sp. 2¼"

BORING MILLS
Giddings & Lewis #6, #25T, Bullard, 42" V.T.L.
Universal 3" horiz., Lucas #3i horiz.

DRILLS AND RADIALS
Canedy-Otto 3'-9" col.
Carlton 5'-10" col., Foote-Burt 6 Sp.
Cinci-Bickford Super-Service 21", 24"
Nates Model E-5 Multi-Spindle, 14 spindles
Sibley 24—28", Allen 6 Sp., Excelsior 21"

ENGRAVERS
Gorton #3U, 3Z, 3L; Deckel 6i.
Gorton Cutter Grinders 375-2, 265-5

GEAR EQUIPMENT
Fellows #045Y, 72, 72S High Speed, Mikron Gear Hasher
Michigan, Gleason, Fellows Checkers
Gleason #2 Surface Hardener

GRINDERS—Miscellaneous
Brown & Sharpe #5 cyl., 3"x10", Black Diamond
Brown & Sharpe #1, #2, #3 Univ., #13 Univ. & Tool
Cincinnati #2 Centerless Filmatic
Cincinnati Universal Filmatic, 12"x36", 12"x48"
Covel #91A Uiv. Tool & Cutter
Gardner #22h, 30" disc, Heald #1 Tool
Heald #72A3 Int. Sizematic
K. G. Lee Tool & Cutter
Landis #4H Cyl. 4"x12", #6 Thread, Landis Centerless
Norton #2 Tool & Cutter, Porter Cable Belt WG6
Oliver #510 Drill Pointer, Sellers #4G
Pratt & Whitney Radius #RG, Crosby Int.

GRINDERS—Surface
Abrasive #34 Vertical, #33
Atlantic 6x18" Power Feed, Foote-Burt Hammond
Blanchard #11—16" chuck, Brown & Sharpe #2 O. & L. #2S, #3S Hyd., 6x16" & 8x24"
Hanchett #300, 13x48", Mattison 14x16x48 Hyd.
Norton 6x18" Hyd., Pratt & Whitney 12x40" Vert.
Reid #2A P.F., #2C Pope & Excello Spdl.
Thompson Hyd. 6x10x18", 6x12x18

LATHES
Bradford 14"x6', Hardinge Precision 9", cabinet
Hendey G. H. 16x30 with relieving att.
LeBlond Regal 10"x3½", 13x30", 19x48", 21x60"
Lodge & Shipley 16x78" T.A., LeBlond HD 16x33"
Monarch 10"x20" EE, 10"x78" T.A., 12x36" CKK
Monarch Model CKK 12x36" Dble. Compound
Rivett Precision, Logan 10"x30"
South Bend 9"x3', 9"x3½", 13x36", 10" Cabinet
Sebastian 12"x4', G.H., Sheldon 11x24, 1" collet

LATHES—Turret
Acme 4W, 6W, Bar and Chuck, 6W Fox Lathe
Bardons & Oliver #3, #5, Foster #3B
Brown & Sharpe #1, #2F Hand Screw Mach.
Gisholt #4, 5 Bar & Chuck—2L Saddle type
Hardinge ESM, 2nd operation
Jones & Lamson #8A Univ., Saddle, Threading
Oster #60i Rapidurtion
Warner & Swasey #3, #4, #5, #4A—6" Bar Cap.

MILLS—Plain & Universal
Brown & Sharpe #2B Pl., #2A Univ.
Cincinnati #3 Plain, 2M H Univ.
Milwaukee 2H, Plain, #2HL, 2M, Univ.
Van Norman #12, 20, 22L, 36 Kempsmith 2G

MILLS—Vertical—JIG BORERS
Brown & Sharpe #2, Index, Vernon, Bridgeport
Cincinnati #4, Jackson
Gorton #6D, 9J Plain, #8½D Duplicator
Kearney & Trecker #3H, 3H High Speed D.T.
P&W 1½B Jig Borer, Sip Jig Borer #MP-3
Moore Jig Grinder, Vernon Jig Borer
Morey #12M Profiler 2 sp.—Pratt & Whitney 12B

MILLS—Production
Brown & Sharpe #000, 12, 2I
Cincinnati #1-12, 1-18, 2-18 Mfg.
Nichols Hand, U.S. MM 1, Kent Owens #1V
Sundstrand #00 Rigidmills, U. S. Duplex

PRESSES
Bliss #8 Dbl. Crank, Bed 42x90", 250 Ton
Bliss #675, 845B, 650 Hi-Production, 384A, 385A
Bliss 406 DBL Crank, D.A., Toggle, Bed 48x54
Bliss #2B, 2I O.B.I., #4½ Dogbie Action Cam
Bliss #3B OB, Gap Frame #6I, 62A, 16I
Ferracute Notching #C62
General Flexible Electric Screw Press
Henry & Wright 25, 75 Ton Dieing
Reliance #45 O.B.I.
V. & O. #102 Reducing
Zeh and Hanneman 30 Tons

MISCELLANEOUS
BAND SAW: DoAll V16, Tannewitz #35M, 36" Marvel #8
BENDING ROLL: Buffalo #8, Excelsior #14
BROACH: 3L LaPointe Horiz. Hydr.
HACKSAW: Marvel #6A Automatic, #6, #4B
HONER: Micromatic #H-1 Hydrohoner, Sunnen
KEYSEATER: Mitts & Merrill, Baker, Davis, Burt
RIVET HAMMERS: Hi Speed, all sizes, Chic. Pneumatic
ROUTER: Onsrud #W240, #58 Oliver
SHAPER: 32" G. & E. Universal
TAPPERS: Bakewell #1, Haskins #2C, 3C
THREAD ROLLER: Waterbury-Farrel #3B with Dies
VERTICAL SHAPER: 6" Pratt & Whitney
WELDERS SPOT & SEAM Taylor Winfield, Elsler 50 KVA, Thompson
WRAPPING ROLL: Buffalo #1½

HYDRAULIC EQUIPMENT

Cap.	Manufacturer	Platen Stroke Opening
500 Ton	Lake Erie	33x36" 30" 60"
600	Bald. Br'thw'k	70x36" 22" 36"
500 D.A.	H.P.M.	36x36" 24" 36"
1000	French Oil	33x42" 20" 50"
300	Verson	48x48" 36" 72"
50	Dennison	22x28" 18" 23"
150	Southwark	54x36" 30'2"to 4'

UP MOVING RAM PRESSES
3000 Ton Tryout and Hobbing
300 Ton Watson-Stillman Hobbing, NEW.
600 Ton Birdsboro 42x32 plates—20" stroke
900 Ton Birdsboro 40x32 plates—20" stroke
800 Ton Birdsboro 40x32 plates—20" stroke
600 Ton Southwark 34x23 plates—20" stroke
100-150 Ton Stokes self contained Molding
300 Ton Dunning and Boschart Molding Press
300 Ton Watson-Stillman 24x30 plates — 8" stroke
500 Ton Self Contained Shaft Straightener.
300—500—600 Ton Wheel Presses

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DO IT TODAY! Replace your old equipment with NOLL REBUILT GUARANTEED MACHINES. (Late type machines of 1941, '42, '43, etc., are indicated by (LT).)

AUTOMATICS

Acme-Gridley 3½" RA-6 Spindle (LT)
Cleveland 4" S.S. Model "A"
Gosa & DeLeeuw 0x6½" 5-Spindle (LT)
Gosa & DeLeeuw 6" 5-Spindle (LT)
Gosa & DeLeeuw 7½" 6-Spindle (LT)

GRINDERS

Arter A3—10" Rotary Surf. Gr. (LT)
Brown & Sharpe #3 & #2 Univ. Grs. (LT)
Brown & Sharpe #5 Cylindrical (LT)
Brown & Sharpe #13 Univ. T&C Gr. (LT)
Brown & Sharpe #22, 10x36 Cyl. Gr. (LT)
Bryant #3 Chucking Grinder (LT)
Cincinnati 6x18 Cylindrical Gr. (LT)
Cincinnati Monoset Cutter Gr. (LT)
Covel #15 Surface Grinder (LT)
Covel #91-A Univ. T&C Grinder (LT)
Ex-Cell-O #31 Plain Thread Gr. (LT)
Hammond #3 Gr., Buffing & Polisher (LT)
Hammond Model #10 D.E. Grinder (LT)
Hanchett #36 40" Rotary Surf. Gr. (LT)
Heald #22—12" Rotary Surface Grs. (LT)
Heald #72 Internal Grinders
Heald #81 Gagematic Internal Gr. (LT)
Heald #81 Bizematic Internal Grs. (LT)
Hill-Acme 18x60 Surface Grinder (LT)
Hisey-Wolf 4F Stand Grinder (LT)
Jones & Lamson 6"x30" Thread Gr. (LT)
Landis 6x30, Type "C" Plain Gr. (LT)
Landis 10x18 Grinder
Norton Type "C" 10x36 Gr. Plain Cyl. (LT)
Thompson 9x18 Surface Grinder (LT)
Rivette #104 Internal Grinder (LT)

DRILLS & RADIALS

Allen 6-Spindle Drill Press (LT)
Avey S.S. #3 Drill Press (LT)
Edlund 4-Spindle Drill Press (LT)
Edlund 6-Spindle Drill Presses (LT)
Foote-Burt #2 S.S. Drill Press (LT)
Fosdick 4'11" Radial Drill (LT)
Natco 4 AL 16-Sp. Drilling Machine

BORING MILLS

Bullard 30" Vert. Boring Mill (LT)
Bullard 62" Vert. Boring Mill
Cincinnati 44" Vert. Boring Mill
Lucas #31 Horiz. Boring Mill
Niles 100" Vert. Boring Mill
Rogers 36" Vert. Boring Mill (LT)

LATHES

American 20x72" Engine Lathe
American 24"x6' Engine Lathe
Bradford 16x54" Lathe (LT)
F'Reid 38"x24' Lathe
Gardner #3 Plain Polishing Lathe
Gisholt #5 Turret Lathe (LT)
Hendey 14" Engine Lathe
Hendey 14"x8' Engine Lathe
Jones & Lamson #5 Turret Lathe (LT)
LeBlond 21x7' Engine Lathe
Lodge & Shipley #3A Duomatic Lathe (LT)
Lodge & Shipley 12x30" Eng. Lathe
Reed-Prentice 14x54 Lathe 8' Bed (LT)
Reed-Prentice 14x30 Lathe 6' Bed (LT)
New Haven 84"x24' Lathe
Wickes 30x16' Bed Engine Lathe

MONARCH
20 x 72" Centers
Engine Lathe
(late type)

FOSDICK
6' 15"
Radial Drill
(late type)

WARNER & SWASEY
#3A Turret Lathe
Bar Feed
(late type)

MILLS

Cincinnati 1-18 Climb Mill (LT)
Cincinnati 2-18 Production Mill (LT)
Cincinnati 2-24 Mill (LT)
Cincinnati 3-24 Hydromatic Mill
Cincinnati #3 H.S. D.T. Vert. Mill (LT)
Cincinnati #3 Plain Mill
Hardinge Vert. & Horiz. Mills (LT)
Kearney & Trecker #2 Plain Mills
Kearney & Trecker #3K Horiz. Mill (LT)
Kent-Owens #1M Hand Mill (LT)
Lees-Bradner 12x36 Thread Mill (LT)
Morey #12-M Vertical Profiler and Milling Machines (LT)
Producto Hand Mill—Model M (LT)

PRESSES

Bliss #30512, S.S. 35 Ton Punch Press
Bliss #56 Punch Press 10 Ton (LT)
MPM 150 Ton Hydraulic Press (LT)
Toledo #S-56 Punch Press 135 Ton (LT)

SHAPERS

Follows #61 Gear Shaper
Morey 14" Vertical Shaper
Pratt & Whitney 6" Vertical Shaper (LT)
Rockford 25" Hy-Draulic Shaper
Smith & Mills 10" Shaper

MISCELLANEOUS

Douglas Slotter Model 7A (LT)
Foster Superfinisher 4"x18" (LT)
Niles 90" Quartering Machine.

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MEMBER MBNA

No. 25T G. & L., 2½" table Hor. Mill, 1942
4" Univ. Table Mill, 60" vert. 96" hor., '43
36" & 42" King Side Hd. Vert. Mills, '43
Nos. 1A & 3 W. & S. Turrets, bar & chuck
Nos. 3 & 2MH Cinci. Pl. Dial Millers, late
Nos. 3K & 9H K. & T. Pl. Dial Millers, late
No. 36 Van Norman Pl. Miller, ram, '43
No. 2G Kempsmith Univ. Miller, 1943 (3)
No. 2418 Keller Duplicators, late
No. 9J Gorton Duplicator & Vert. Miller (2)
12"x24" G. & L. No. 43 Surface Grinder, '42
No. 70A Heald Internal Grinder, 1942
Gear Cutter, No. 13 B. & S., spur & bevel
No. 6 M. & M. Keyseater, AC. M.D.
30"x36" cen. Axelson Lathe, T. A.
30"x120" Hanchett Plano Surface Grinder

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2 Birdsboro 156"x½" Power Gap Shears, 15" Gap, Back Geared, w/extra blades.
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Waterbury-Farrel Fdry. ⅝" and 1" D.S. S.D. Cold Headers, also Thread Rollers.
Fisher 5" Bar, Floor Type Boring Mill. New in 1942.
Niles, Bement, Pond 60"x60"x24' table 4-Head Planer, Rev. D.C. M.D.
Bliss Presses in all sizes up to 1,000 ton capacity.
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233 Lucas, 4½" bar, equipped with heavy OVERHEAD VERTICAL MILLING ATTACHMENT, 36" ROTARY TABLE; extra width, extra height; brand new leadscrews and nuts for the head; 10 hp motor; excellent.

3" bar UNIVERSAL "Tri-Way", standard machine, 1942.

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BAUSH W-6 and W-7 Multiple Spindle Drills.
NATCO 2BL "Holesteel" Multiple Spindle Drills
50"x204" LeBLOND "Big Swing" Lathe
32"x36"x66" ROCKFORD Openside Shaper, Planer, 2 hds.
10"x72" NORTON Type "C" Plain Cylindrical Grinders.

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LEES & BRADNER SER. HT 612
6" Spin. hole, swings 24"x102", gearing, collets, fifty hobs mostly new. Connected and can be demonstrated.

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INDUSTRIAL CHILLING MACHINE
DEEPFREEZE CASCADE 120° F. Height 80" Length 82", Width 32½". Approximately 7½ cubic feet. WITH 2 MOTORS, ½ and ¾ HP. 6/60/220.
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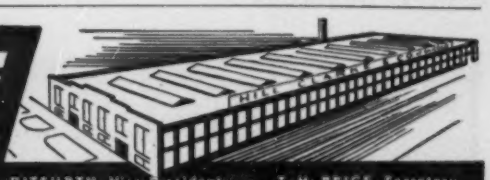

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AUTOMATICS
1⅝" Greenlee, 6 Spdls. (1941)
No. 61 New Britain 6 Spdls. 1¼" (1942)
No. 6 Brown & Sharpe, M.D.
No. 4B New Britain, 4 Spdl. Chucker
Model A 1⅛" Cleveland (1943)
Model A 3¼" Cleveland (1942)

DRILLS
No. 150 Baker, tapping (1942)
No. D8 Colburn, No. 6 Morse Taper
No. 4-BM Foodick 4 Spdl. (1942)
No. 4-BM Foodick 8 Spdl. (1942)
No. 1-LMS Leland-Gifford (1942)
No. 2-LMS Leland-Gifford (1942)
No. 4BL Natco 36 Spdl. (1943)
5' Western Heavy (1942)
6'-17" Foodick Hyd. Economax Radial

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 18H Gould & Eberhardt
72" Cincinnati Gear Cutter

BORING MACHINES
No. 356—T Giddings & Lewis 5" Bar
No. 31 Lucas 3" bar, M.D.
No. 46-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
36" Bullard Hi-Speed (1942)
42" Bullard (1944)
42" Colburn, M.D.
80" Colburn, M.D.
72" Niles Extra Heavy
84" Betts, M.D.

GRINDERS
3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
10"x96" Landis type C hydraulic (1942)
Norton Motorized Grinders ranging from 6"x18" 24"x240"
12"x48" Cincinnati Univ. (1946)
72A-3 Heald Internal Grinder (1942)
72A-5 Heald Internal Grinder (1942)
74 Heald Internal Gdr. (1942)
Bryant Internal Grinders (1942)
Model HRF Barber-Colman Hob & Reamer Sharpener (1942)

LATHES
14"x30" centers Pratt & Whitney, Model C
16"x54" centers LeBlond (1941)
16"x80" centers Pratt & Whitney, Model B
16"x6' American, Gdr. Head, M.D.
20"x8' American Geared Head M.D.
36"—48"x16' Lehman Hydratrol (1945)
36"x24' Ledge & Shipley Gdr. Head
8"x15" Sundstrand, Model D (1943)
16" Sundstrands (1942, 1943)
16" & 20" Fay Automatics (1942)
No. 2 Warner & Swasey, Bar Fd. (1942)
No. 4 Gisholt Univ. Turret Lathe, (1942)
No. 4B Libby, Bar Feed (1942)
No. H-5 Libby
No. 5 Bardons & Oliver (1942)
No. 5 Midland, Bar Feed (1942)
1-A Warner & Swasey (1943)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle

MILLING MACHINES
No. 2H Milwaukee Plain & Vertical (1942)
No. 2 Cincinnati Vert. (1943)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cincinnati Mfg. (1942)
No. 2—18" Cincinnati Rise & Fall (1941)
No. 2—18" Sundstrand-Electromil (1942)
No. 4-48 Cincinnati Hyd. Tracer (1943)
No. 34-48 Cincinnati Hyd. Duplex (1943)
No. 45-48 Cin. Hyd. Tracer (1941)
No. 56-72 Cincinnati Hydromatic
4½"x12" Pratt & Whit., Model C Thread Mill
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread (1942)
24"x24"x12' Ingersoll Adj. Rail Slab Miller
36"x36"x16' Ingersoll Slab Miller, 4 Hds.
No. 10 Ingersoll 72"x8' Travelling Col. Face Millers (1942)
No. 28-60 Cincinnati Hydrotel

MISCELLANEOUS
18" Dill Slotter
Micromatic Vertical & Horizontal Hydrohoners

PLANERS
36"x36"x12' Cincinnati
36"x36"x18' Gray Maxi Service, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads

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CRANE—Milwaukee 10 ton 65' Span (1943)

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Z & H #7, 50 ton, Percussion
Bliss #6, 125 ton, Late
Clearing, 200 ton, Late
Bliss #310, 450 ton

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36"x¾" Pyramid
11'x¾" Initial
15'x3" Pyramid Vertical
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Ohl 10'x¾" (old)
PLATE EDGE PLANER:
N & J 32"x2"
PLANER
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Bullard Multaumatics, 16", 12", 8", late
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#28/60 Vertical Cincinnati Hydrotel, '44
2300 ton Bliss Hydraulic Press, sacrifice, late!
#2, #3 Cinci. Dial type, Univ. Mills
6'17" Column American Hole Wizard Radial Drill, AC Motor on Arm
5" Fisher Horiz. Floor Type Boring Mill, Late
5" Bar Table type boring mill, Giddings & Lewis #350T
#12 Brown & Sharpe Production Mills, 48½" x12" table size, $2250.00 ea.
#18 Blanchard Surf. Grinders 36" chuck, late type
9/16", 1", 1¼", 1½", 2½", 2¾" RAS Acme Gridley Auto.

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All sizes spot welders, air & foot operated. 25% off list price.
Hand Brakes all sizes up to 10'

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B & S Auto. Screw Machines #20—1½" late—#2—1½"
Bliss Swiss Jig Borer #3B
Pratt & Whitney #2 Jig Borer
Cleerman Drill Press 29" Box Column, #4 M.T.
American Hole Wizard Radial 6'x15" cal.
Leland Gifford Single Spindle #2LMS
Reed Prentice 20"x8' G.H. Lathe, late type
Headey Lathe 12"x42" G.H. Centers (1947)
Bradford Lathe 16"x6' G.H. Late
Warner & Swasey Turret Lathes #1A, #3A, #3, #5
Bardons & Oliver Turret Lathe #5, Preselector, 2"
Morey Turret Lathes #2 & #3 Univ. (1946)
Cincinnati Universal Miller #2MH & Vert. Attach.
K & T Plain Horiz. Miller #2H, with Vert. Attach.
Van Norman Model #2L & Cincinnati #2MH Plain Millers
Cincinnati Vert. Millers #2 & #3 Dial Type
K & T Vert. Miller #3KM, with Power Rotary Table
Rowbottom Cam Miller
Do-All Hydr. Surface Grinder Model #G-7
B & S #1, & #3 Universal Grinders
Cincinnati Univ. 12"x36" Grinder, Int.-Ext.
Blanchard Vert Spindle Surface Grinder #16
Gould & Eberhardt 20" Shaper (1943—Smith & Mills 10" (1946)
Gleason Spiral & Bevel Gear Cutters 3" & 24"
Armstrong-Blum Model #8A Hack Saw, Auto. Feed
Watson-Stillman 700 Ton Hydr. Nabbing Press
Heald Plain Int. Grinder #72-A-3
Pratt & Whitney 15"x30" Tool room Lathe
K & T #3H Vert. Miller
Van Norman #1V Vert. Miller
K & T #1H-10 Mfg. Miller
Yates American #G-67 Auto Bin Saw
Lucas #41 Horiz. Precision Boring Mill
Ruesch Percussion Press #2
Lees Bradner 12"x54" Model HT Thread Miller

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DEEP HOLE DRILL
Baush Horizontal Deep Hole Drill, rifle Barreling machine, with two motors, and two 3 jaw chucks, double end. *Late Type*
PRICE — $1,500.00
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USED MACHINERY FOR SALE
1—48"x48"—10 ft. Liberty Heavy Duty, Double Housing Planer. Factory rebuilt, equipped with 2 rail heads, 1 side head, tool lifters all heads, arranged for reversing variable voltage drive, but not including driver. Price—$18,000.
MR. WARNER, LIBERTY PLANERS, INC.
HAMILTON, OHIO

Bar. Mill, Hor. 4½" Bar N-B-P
Bar. Mills, Vert. 24"-30"-42"-60"-72"
Drills, Radial, 3'-4'-5'-6' Cin.-Bick.
Grinder Surface, #2 Diamond, Mag. chuck.
Lathes, Turret, 2A W. & S., and 20" Gisholt.
Millers, Plain, No. 3, 4, & 5-B Cincinnati.
Millers, Vert. No. 3 & 4 Cincinnati.
Shaper, Draw Cut, 20" Morton.
Swager, #3 Etna, 1½ tubing.
West Penn Machinery Company
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SEABOARD STEEL CO., INC.
New Haven, Conn. 8-0929

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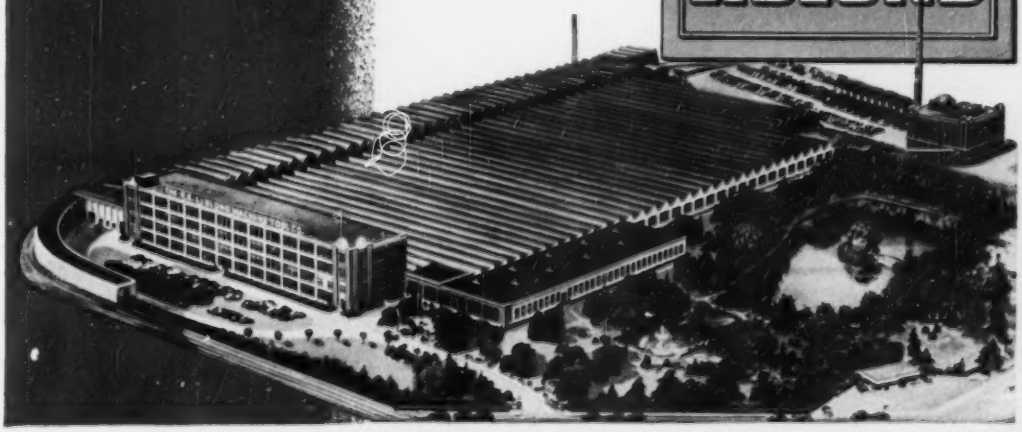

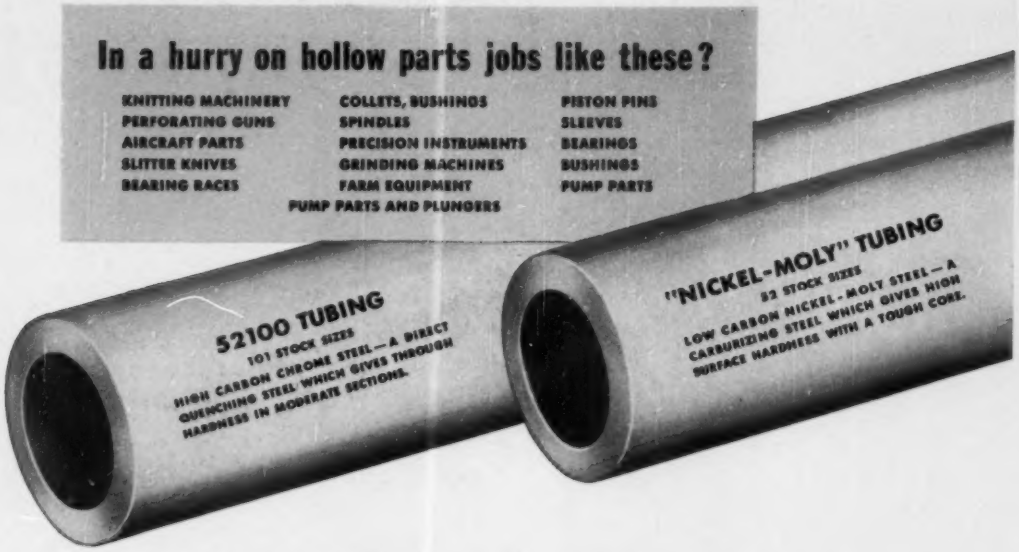

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